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## THE FOOT-ROT DISEASE OF WHEAT.

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FOOT-ROT of wheat is a condition associated with the presence of one or more pathogenic fungi on the underground parts of the plant. In recent years a good deal of attention has been paid to the disease in other wheatgrowing countries, and the following is an account of an investigation of the disease as it occurs in Canterbury.

### SYMPTOMS.

The disease may be observed throughout the growing period of the crop, and the symptoms at the different stages are described below.

*Seedling Blight.*—Wheat-fields examined six to seven weeks after sowing are found to contain certain dead seedlings or seedlings showing discoloration and wilting. Such seedlings do not occur in patches but are distributed evenly along the rows, among apparently healthy plants. They can be pulled up easily, when it is noticed that the underground portion of the stem has rotted through above the grain (see Fig. 1). In 1934 the degree of seedling blight in crops examined was as high as 22 per cent. ; in 1935 two fields were examined in which there was over 40-per-cent. loss of the seedlings.

*Spring-yellow.*—In early spring, backward, yellowish, tip-withered plants may be observed. These may be scattered, or the whole crop may be affected. They possess a poorly developed root system, characterized by the absence of fibrous roots. It appears that the seedlings are attacked as in the case of seedling blight, and the underground stem rots through, but, in the condition known as spring-yellows, adventitious roots develop above the "foot-rotted" area and enable the plant to survive. According to growth conditions these seedlings apparently recover from the attack to some extent and produce small ears. Spring-yellow seedlings are also shown in Fig. 1 along with typical examples of seedling blight.

*Whiteheads.*—The presence of "whiteheads" soon after flowering, when the crop is still green, has often interested the farmer. "Whiteheads" is usually a secondary condition resulting from the fracture of tillers at the ground-level. Laboratory examination of pieces of such fractured tillers has shown that in some cases pathogenic foot-rotting fungi were responsible. In other cases, however, the fracture has been shown to be due to weevil attack(1).

*Wheat-scab*.—At harvest-time there may be found among normal ears a number of small ears covered with pinkish-brown lesions. Sometimes the florets are sterile and contain a mass of pink fungoid growth. Any grain formed is usually shrunken and bleached. This condition has been proved to be caused by the same organism responsible for the other conditions described. Bennett(2) found that the fungi do not cause scab by growing up the stem from the soil or infected seed, but that fungus-spores from infected soil are blown on to the flowering ear, where they germinate and produce a fungus growth, causing the diseased-ear condition.

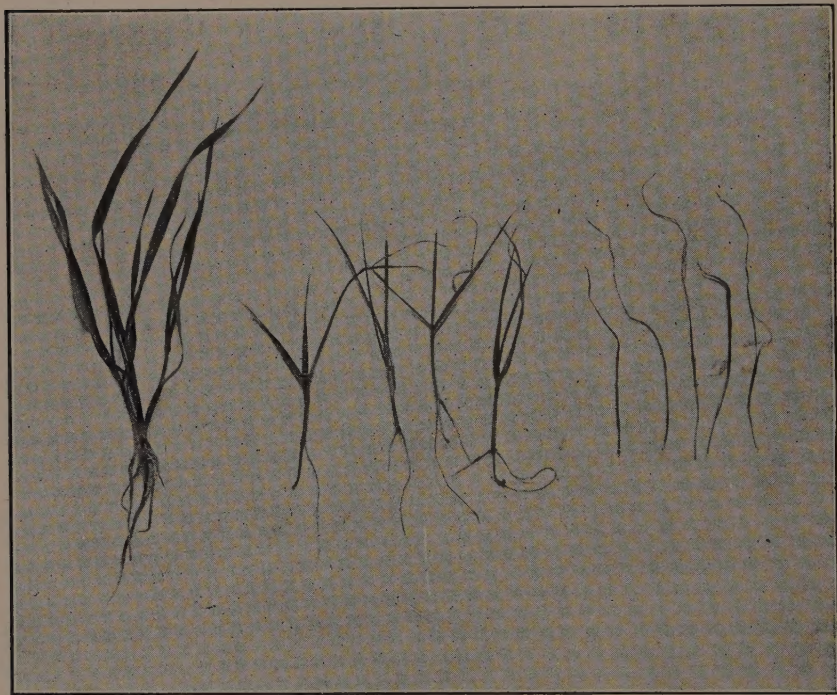


FIG. 1.

Left : Normal healthy seedlings.

Centre : Spring-yellow seedlings. Note development of adventitious roots above the point where underground stem has rotted through.

Right : Typical examples of seedling blight ; all specimens gathered from one field of Tuscan wheat about six weeks after sowing.

[Photo by J. W. Calder.

#### ECONOMIC IMPORTANCE.

Foot-rot is responsible for considerable plant mortality and loss in yield. In 1926-27 yield losses of 50 per cent. to 70 per cent. were recorded in England(3). Weniger(4) estimated that the disease caused a loss of 6,000,000 bushels of wheat in North Dakota in 1919. The disease is considered the most economically important in Australia as far as wheat is concerned. Geach(5) reports plant losses of 20 per cent. to 30 per cent. in New South Wales, and Geach estimated the average annual yield-reduction at the very conservative figure of  $2\frac{1}{2}$  per cent.

No previous work has been conducted on the disease under New Zealand conditions, but it has been known to be present for a number of years. Reports indicate that the conditions described above are becoming more prevalent, and it would appear that in the past the condition has been confused with take-all (*Ophiobolus graminis*), or with grub, or with weevil attack.

During the course of a two years' investigation throughout the Canterbury wheatgrowing area, a mortality of 10 per cent. at the seedling stage was quite common, and in some fields was as high as 46 per cent.

#### CAUSES OF THE DISEASE.

Simmonds(6), in Canada, found that certain species of fungi occurring free living in the soil and in diseased grain were responsible for the disease. The chief of these fungi proved to be species of *Helminthosporia*, *Alternaria*, and *Fusaria*. During the past two years laboratory isolations from dead and diseased wheat plants and grain revealed the presence of a pathogenic form of *Fusarium*. This has been identified as *Fusarium culmorum* and appears to be widespread as the principal cause of the disease. *Helminthosporium* was very rarely found, but *Alternaria* were the most commonly occurring fungi on grain, although they were rarely isolated from foot-rotted seedlings.

#### NATURE OF THE DISEASE.

The pathogenic organism causing foot-rot appears to be a weak parasite, and the incidence of the disease depends upon a balance between host plant and parasite. If the soil and cultural conditions are such as to promote a vigorous development of wheat-plants, the crop apparently grows away from the disease. On the other hand, when conditions are against normal healthy development of the crop, the condition of balance swings in favour of the fungus and the disease appears to be more or less severe according to the vigour of the crop. There are certain predisposing factors associated with the appearance of the disease, and for the purpose of studying these a survey was made of wheat crops at various stages of development. The question of varietal susceptibility was considered. Tuscan, Hunters, Cross 7, Jumbuck, Marquis, Hollow-strawed Tuscan, Velvet, and Garnet all revealed some degree of seedling blight, and all these varieties appear to be equally susceptible to attack. This general susceptibility of varieties was the first evidence of the presence of a number of predisposing factors which are considered below.

#### CONDITIONS ASSOCIATED WITH THE DISEASE.

The following is a summary of the results of the field survey of over 100 wheat crops in various districts throughout the Canterbury wheatgrowing area.

*The Effect of Cropping Rotations.*—Of the crops examined, only thirteen showed no sign whatever of seedling blight. Of these thirteen crops, some had been sown after wheat, grass, mangels, rape, red clover, and peas in the rotation. On the other hand, many instances were found

where infected crops followed each of these in the rotation. As a result of the field survey, the conclusions drawn with regard to the effect of rotations were—

- (i) Foot-rot is likely to occur after any crop :
- (ii) The most severely infected fields were all sown after summer fallow for twitch :
- (iii) Growing wheat for two to three years on one area does not appear to result in increased infection.

*Other Host Crops.*—Varying degrees of infection of the same variety sown after the same kind of crop led to an examination of the possibility of other hosts acting as sources of infection. In all fields where there happened to be a heavy infestation with *Agropyron repens* or old-man twitch the percentage of seedling blight was always high. Pieces of the rhizomes of twitch from affected fields were examined in the laboratory, and pathogenic *Fusarium* cultures were obtained. Old stubble of previous wheat crops was also shown to be a carrier of *Fusarium* fungi. On one farm perennial rye-grass had been sown down in a field which, during the previous year, had been badly affected with seedling blight of wheat. Eight months after sowing the rye-grass, patches of stunted plants stood out distinctly. The underground portions of such plants were found to be carriers of *Fusarium* fungi.

The appearance, therefore, of badly diseased crops of wheat in fields infested with twitch, or sometimes after grass or a diseased crop, may be explained by the fact that the organism is able to persist in a field by these means. In Canada(7) brome-grasses and barley-grass have also been shown to be carriers of foot-rot fungi.

*Influence of Soil Fertility.*—The disease appeared to be more severe on heavy wheat land than on lighter land. This is in keeping with the belief of Bennett(2) that the presence of much organic matter in the soil enables the organism to live saprophytically for long periods. Concerning soil fertility as influenced by the use of artificial fertilizers, all crops examined were manured with superphosphate or with proprietary mixtures. There was no connection between the kind of manure or the quantity applied and the incidence of the disease, which varied from 0 per cent. to 46 per cent. of seedling-blight infection.

It is interesting to note that one farmer drilled several alternate strips in a 30 acre field of autumn-sown Tuscan without any super. At the seedling stage these unmanured strips stood out distinctly as being more infected with seedling blight and spring-yellows than the manured strips.

This is further evidence in favour of the hypothesis that factors promoting vigorous growth of the plant tend to decrease its susceptibility to attack. In connection with soil fertility, acidity-measurements were made of the soil of several wheatfields affected with the disease, and the results showed that where the soil acidity was high the percentage of seedling blight was also high.

#### THE CONTROL OF THE DISEASE.

The conclusion regarding this aspect of the problem is that there is no specific means of control which will give immediate results. It has been indicated that there are several factors which predispose the plant to attack by foot-rotting fungi. If conditions favour the pathogenic organism occurring naturally in the soil on organic matter or on other

host plants and seed, a severe attack of the young seedlings will take place. Control methods, then, must aim at building up the resistance of the plant by cultural methods to ensure normal healthy plant-development or by treatment of the growing crop. As the disease is to some extent seed-borne, seed-treatment as a means of control must also be considered.

#### CULTURAL CONTROL.

*Crop Rotations.*—It has been found that during 1934 and 1935 in Canterbury the disease occurred after all the commonly grown crops, and was not likely to be any more severe after wheat than after peas, for example. This suggests that ordinary cropping rotations in the Canterbury wheatgrowing area cannot be altered to any extent to bring about a reduction in the incidence of foot-rot.

Where a field is badly diseased one year the farmer will certainly not be advised to sow wheat again on the same area for some years, as the soil is probably badly infected.

*Cultivation.*—Schmidt and Feistritzer(8) concluded that "Foot-rot of wheat was reduced by directly turning under the stubble to a depth of 34 cm. (13½ in.). The practice of skim-ploughing the stubble perpetuated the disease. Deep ploughing therefore seems desirable." Land should be made as clean as possible by the removal of carriers of the disease—viz., *Agropyron repens* and other hosts. It was noticed that heavy infection occurred on loosely consolidated fields, probably due to deep sowing, while on an infected field in which wheat plots were sown by hand, and which was consolidated by tramping, no disease appeared in the wheat plots following the diseased field crop. A well cultivated and consolidated seed-bed favours vigorous growth, and this is associated with low infection.

*Effects of Time of Sowing.*—In a time-of-sowing trial duplicate plots were sown at fortnightly intervals in soil artificially inoculated with cultures of a pathogenic *Fusarium* isolated from typical diseased plants. The results are shown in the following table:—

Table 1.—Showing Germination Percentage in *Fusarium*-inoculated Rows of Wheat sown at Fortnightly Intervals.

| Time of Sowing. | Average Germination. |             |
|-----------------|----------------------|-------------|
|                 | Control.             | Inoculated. |
| 1935.           |                      |             |
| April 16 .. ..  | 100                  | 82.5        |
| April 30 .. ..  | 100                  | 82.5        |
| May 14 .. ..    | 99                   | 79.0        |
| May 28 .. ..    | 99                   | 75.0        |
| June 11 .. ..   | 98                   | 60.5        |
| June 28 .. ..   | 98                   | 71.0        |
| July 9 .. ..    | 98                   | 79.5        |
| July 23 .. ..   | 99                   | 86.0        |
| August 7 .. ..  | 98                   | 86.5        |
| August 14 .. .. | 97                   | 88.0        |

From this table it is seen that the winter-sown crops are more severely attacked by foot-rotting fungi than spring- or autumn-sown crops. From the end of May until the end of June the most severe mortality occurred. This corresponds with that period when growth and germination are very slow. Later on, as in August, the development of young plants appears to be sufficiently vigorous to be able to withstand the fungus attack to a greater extent.

*The Effect of Depth of Sowing.*—In a similar manner triplicate plots were sown at different depths in inoculated soil. The results are summarized in Table 2.

Table 2.—*Germination Percentage of Fusarium-inoculated and Non-inoculated Plots sown at Different Depths on 20th June, 1935.*

| Depth of Sowing. |    |    | Control. | Inoculated. |
|------------------|----|----|----------|-------------|
| 4 in. ..         | .. | .. | 75.0     | 57.0        |
| 3 in. ..         | .. | .. | 81.0     | 65.0        |
| 2 in. ..         | .. | .. | 82.5     | 75.5        |

The results suggest that the deeper the seed is sown the more predisposed it is to attack by foot-rotting fungi.

#### CROP-TREATMENT CONTROL.

By crop treatment is meant the use of artificial fertilizers to stimulate plant-growth. It has been seen that manurial treatment does not prevent the disease. On the other hand, it may be a means of control by stimulating diseased plants to healthy development.

With this in view, a top-dressing trial was conducted in the spring of 1934 on an area of a wheatfield badly infected with seedling blight and spring-yellows. A mixture of superphosphate and sulphate of ammonia was applied at the rate of 2 cwt. per acre. Observations were made on the reaction of marked plants in the diseased area. The spring-yellow plants were found to have responded remarkably to the stimulus of manurial top-dressing, whereas the untreated plants succumbed later in the season or developed into very poor and stunted plants, which did not come into ear.

From these observations it will appear that plants checked (not those killed by seedling blight) in the seedling stage recover to a considerable degree if the plants are stimulated by fertilizers. By encouraging the early development of the susceptible or slightly affected plants, they "outgrow" the effect of the disease organism. Figs 2 and 3 show the effect of top-dressing at two stages in a crop-development.

#### SEED-TREATMENT CONTROL.

A review of work on this aspect shows that although seed-treatment methods have been tried extensively, they have been attended with little success. Greaney(9) inoculated soil with *Fusarium* and found that pickled seed was not significantly better than untreated. On the other hand, Christensen and Stakman(10) found that barley-seed treated with Ceresan resulted in significantly better stands and more vigorous growth of seedlings in soil inoculated with *Fusarium*.

A seed-treatment trial was conducted during 1935. Five replicates of pickled and unpickled seed were sown in *Fusarium*-inoculated and non-inoculated soil. The results, expressed as percentages of germination, are shown in the following table:—

Table 3.—Effect of Seed-pickling in Plots inoculated with *Fusarium*.

| Seed unpickled,<br>Soil<br>non-inoculated. | Seed unpickled,<br>Soil<br>inoculated. | Copper<br>carbonate, Soil<br>inoculated. | Ceresan,<br>Soil<br>inoculated. | Agrosan,<br>Soil<br>inoculated. |
|--------------------------------------------|----------------------------------------|------------------------------------------|---------------------------------|---------------------------------|
| 85                                         | 77.8                                   | 83.8                                     | 81.8                            | 80.6                            |



FIG. 2. EFFECT OF TOP-DRESSING: SIX WEEKS AFTER TREATMENT.

Left: Typical *Fusarium* spring-yellow seedlings which had not been top-dressed.

Centre: As above, but which had been top-dressed with superphosphate and sulphate of ammonia.

Right: Typical healthy plant, which had received no treatment.

[Photo by I. D. Blair.

In this trial seed pickled with Ceresan, Agrosan, and copper carbonate and sown in *Fusarium*-inoculated soil all gave significantly better germinations than unpickled seed. However, infection was not very severe, and, in spite of the seed treatment, the mortality was higher in the inoculated plots compared with the non-inoculated, indicating that seed treatment cannot be relied on as a control measure.

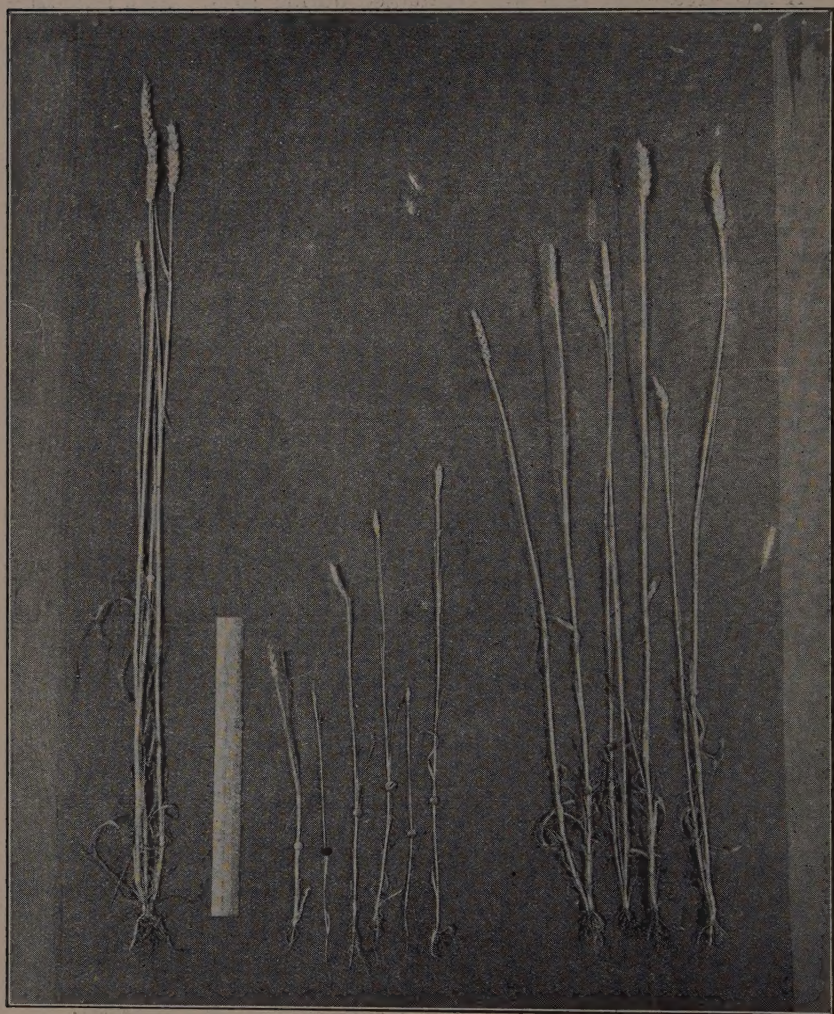


FIG. 3. EFFECT OF TOP-DRESSING : HARVEST STAGE.

Left : Typical healthy plant, without top-dressing.

Centre : Plants which developed from *Fusarium* spring-yellow seedlings, and which had not been top-dressed.

Right : As above, but which had been top-dressed with superphosphate and sulphate of ammonia.

[Photo by J. W. Calder.]

#### SUMMARY.

Foot-rot of wheat is a symptom of a disease caused mainly by *Fusarium* fungi which attack the roots and underground parts of the plant. As a result of attack during the growing-season, different conditions described as seedling blight, spring-yellows, whiteheads, and scab are all associated with the disease. The organism occurs also on *Agropyron repens*, rye-grass, and certain weed-grasses, and can persist

in a soil on an aftermath of diseased crops. It is also seed-borne. It has the character of a weak parasite, which becomes serious in its effect when the plant is weakened by such adverse growing-seasons as cold, deep-sowing, poor tilth, &c. Control must be directed towards the preparation of a weed-free firm seed-bed and avoiding sowing too late in the season—i.e., very cold soils. Top-dressing diseased crops in spring alleviates the severity of the disease. Seed-pickling as a means of controlling foot-rot does not seem to offer much promise.

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## CHEMISTRY OF WEED-KILLERS.

(Continued.)

### VI. THE BISULPHITE GROUP.

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EXPERIMENTS in which ammonium thiocyanate (sulphocyanate) was used as an agent for killing ragwort (*Senecio jacobaea*) were described in the March, 1935, issue of this *Journal*, and in continuation of the series of articles similar trials with another class of chemical—namely, bisulphites—are described herein.

As in the previous articles, the weed chosen for the experiments is that one at present giving the greatest anxiety to the cattle-farmers of this Dominion, the ragwort (*Senecio jacobaea*).

In these experiments three different bisulphite salts were used—sodium bisulphite ( $\text{NaHSO}_3$ ), potassium bisulphite ( $\text{KHSO}_3$ ), and sodium ammonium bisulphite ( $\text{NaNH}_4(\text{HSO}_3)_2$ ). In addition, a locally obtained commercial bleaching-powder, consisting largely of sodium bisulphite, was tried.

## PROPERTIES OF THE BISULPHITE COMPOUNDS.

The sodium and potassium salts are in the form of finely divided, non-combustible, and non-poisonous white-powders, while the sodium-ammonium bisulphite is of a brownish appearance and is more coarse-grained. The substances under discussion do not absorb moisture in the same way as do thiocyanates and those proprietary chlorate preparations which contain calcium chloride to reduce fire risks; their dry nature rendering them convenient for handling and mixing with other compounds. Bisulphites gradually liberate a little sulphur di-oxide gas under certain conditions, and may therefore lose some of their potency as weedicides if the materials are unduly exposed to air. They are manufactured principally for bleaching purposes, and are usually sold in a fairly refined state in air-tight, metallic drums of  $\frac{1}{2}$  cwt., 1 cwt., and 5 cwt. size.

The salts are readily soluble in water, with the exception of the sodium-ammonium bisulphite, which is rather slow in dissolving at a 15-per-cent. strength.

The bisulphites have the advantage compared with ammonium thiocyanate: that the utensils employed do not tend to rust and corrode.

## SPRAYING TRIALS.

The Lower Hutt and Rotorua trials were conducted simultaneously and in the same localities as the previously described thiocyanate experiments.

*Lower Hutt.*—In the spraying experiments conducted in this district the plots were each 24 square yards in area, and the solutions were applied at the rate of 200 gallons per acre, as this was the minimum quantity which would give complete coverage with the small spraying-apparatus used. After treatment the plots were kept under frequent observation, and the percentage of kills recorded are based on the number of surviving plants when the latest counts were made some months afterwards.

The results of the various spraying experiments are summarized below:—

| Treatment.                  | Sprayed.               | Result.            |
|-----------------------------|------------------------|--------------------|
| Sodium bisulphite—          |                        |                    |
| 5 per cent. .. ..           | 2nd November, 1934 ..  | Unsatisfactory.    |
| 10 per cent. .. ..          | " ..                   | "                  |
| 15 per cent. .. ..          | " ..                   | 95-per-cent. kill. |
| Sodium ammonium bisulphite— |                        |                    |
| 5 per cent. .. ..           | " ..                   | Unsatisfactory.    |
| 10 per cent. .. ..          | " ..                   | "                  |
| 15 per cent. .. ..          | " ..                   | 85-per-cent. kill. |
| Potassium bisulphite—       |                        |                    |
| 5 per cent. .. ..           | 23rd November, 1934 .. | Unsatisfactory.    |
| 10 per cent. (cut) ..       | " ..                   | 95-per-cent. kill. |
| 10 per cent. (uncut)* ..    | " ..                   | 90-per-cent. kill. |
| 15 per cent.* .. ..         | " ..                   | 90-per-cent. kill. |
| Sodium bisulphite—          |                        |                    |
| 15 per cent. .. ..          | 7th December, 1934 ..  | Unsatisfactory.    |

\* The spray-pump was not working satisfactorily, and gave uneven coverage during the application of these two solutions. With normal working-conditions the results would probably be about 95-per-cent. kill, or even higher, with the stronger solution.

The ragwort on the plots sprayed with 15-per-cent sodium bisulphite on 7th December was at a more advanced stage of growth, and was just entering the flowering-stage. The ragwort on one of the plots treated with 10-per-cent. potassium bisulphite was cut a fortnight before the spraying, and in the interval the plants had regrown sufficient foliage to enable them to be covered with an effective quantity of spray. The results indicate that the cutting in this particular case made no appreciable difference, whereas experiments with other weed-killers—*e.g.*, chromates—have shown that spraying after cutting before there is any regrowth gives unsatisfactory results.

After treatment the pasture on the plots had a very bleached appearance, and although checked for several days it quickly recovered, and in most cases was back to normal again in less than a month.

*Rotorua*.—Mr. C. R. Taylor, a field officer of the Department at Rotorua, conducted a number of experiments with bisulphite compounds on ragwort-infested farms on pumice soils. The following is a summary of his report on treatments made early in November, 1934, when the weather conditions following the spraying were moderately moist:—

10-per-cent. solution sodium ammonium bisulphite: Very unsatisfactory.

10-per-cent. and 20-per-cent. solutions sodium bisulphite: Severe on all vegetation, grass almost normal in three weeks, 100-per-cent. kill of ragwort, thistle, plantain, catsear, daisy, hawkweed, &c. The weaker solution was less severe on the pasture.

10-per-cent. and 20-per-cent. solutions of potassium bisulphite and the bisulphite bleaching-powder obtained locally gave results similar to the sodium bisulphite. The potassium bisulphite was more severe than the sodium salt. Mr. Taylor considered that probably a 5-per-cent. or 7-per-cent. solution of the bisulphites would give the best all-round results.

*Miramar*.—During December, 1935, experiments were carried on with bisulphites in this locality, where the ragwort-infestation is greater than in the Lower Hutt experimental area, averaging about 55,000 plants per acre. The soil is an exceptionally heavy clay loam, and the weather at the time of spraying and for some weeks afterwards was fairly dry. The results of 12-per-cent. solutions of both sodium and potassium bisulphite at 200 gallons per acre were not satisfactory.

It is interesting to note that at Miramar the plants are much smaller and mature later than is customary for ragwort in the North Island. They appear to be hardier owing to their being exposed to the strong northerly and cold southerly winds which characterize the climate near Wellington's seaboard. The plants certainly appear more resistant to chemical sprays, and it is as yet difficult to say whether this is due to the soil condition, climate, type of plant, or a combination of these factors. Even treatments with sodium-chlorate solution under the conditions at Miramar are not always completely successful—for example, the kills being 75 per cent. to 80 per cent. and less with 3-per-cent. to 5-per-cent. solutions.

## DRY APPLICATIONS.

The method of applying the weed-killer dry, mixed with superphosphate, as previously described in the article on ammonium thiocyanate, was also tried with the locally-obtained bisulphite bleaching-powder. Five plots were treated with different quantities of the material, equivalent to amounts varying from  $\frac{1}{2}$  cwt. to 4 cwt. per acre, which were mixed with superphosphate applied at the rate of 4 cwt. per acre.

Although the foliage on the plots had a bleached appearance for the first week, the treatments were entirely unsuccessful, and after a period of approximately a month the plots were practically normal in all respects. One plot which was treated with the bisulphite alone at the rate of 2 cwt. per acre showed a slight reduction in the number of ragwort plants. Since the ragwort plants on these plots were large and tall a considerable amount of the material was caught in the foliage, and in the absence of rain it remained there for some time before reaching the base of the stems and the roots. In the interval the bisulphite may have decreased gradually in potency. Treatment on smaller plants or under more moist conditions would possibly be more successful.

Dry applications of sodium bisulphite were made on young ragwort using one of the mechanical devices described in the previous article. The apparatus liberated a small quantity of material each time it was stamped on the crown of a ragwort plant. The operation was very effective, resulting in practically 100 per cent. of kills, but, of course, only individually treated plants were affected.

## DISCUSSION.

A comparison of the effects of the treatments in the various experimental areas shows that 10-per-cent. solutions of both sodium and potassium bisulphite gave 100 per cent. of kills at Rotorua, while at Lower Hutt they were both unsatisfactory. In the latter experiments the small plots were laid down on areas thickly infested with ragwort where the entire plot required spraying, and the solution was applied at the rate of 200 gallons per acre. At Rotorua Mr. C. R. Taylor applied the spray to each plant or clump of plants until well wetted all over with solution, and drops just began to fall from the foliage, care being taken not to spray the pasture any more than could be helped. The marked differences in the results may therefore be attributed to differences in the volumes of solutions used, but as it is possible that Mr. Taylor applied less solution than the 200 gallons per acre sprayed at Lower Hutt, another explanation may have to be sought. The failure of the treatments at Miramar also requires some explanation.

Crafts ("Effectiveness of Sodium Chlorate as a Herbicide," *Hilgardia*, Vol. 9, 1935, page 437), in a comprehensive series of experiments, showed that sodium chlorate is more effective when applied to the soil than when applied as a spray to the foliage of the various weeds. Further, the effectiveness of spraying the living foliage involves the complicating factors of rapid absorption by the foliage and subsequent root-killing by translocation of the toxic chemical within the plant. These two factors are in turn governed by the time of day the spray is applied, stage of growth, and amount of moisture in the soil. Pammel, in his exhaustive treatise on "Weeds of Farm and Garden" (1920), draws attention to the importance of atmospheric moisture, temperature, wind, and amount of dew at the time of spraying-operations.

According to Crafts, the effectiveness of applications of the chemical to the soil depends on the porosity of the soil, and proper vertical distribution of chlorate within the soil by sufficient leaching rains. He found that when advantage is taken of all factors influencing treatment through the plant and through the soil the effects are apparently additive and the best results are obtained.

In the light of Craft's work the loose, porous character of the Rotorua pumice soils may explain the success of weed-killing treatments in that locality, compared with the less satisfactory results on the less-porous, heavy clay soil of Miramar. The Lower Hutt soil may be regarded as intermediate in texture, being of an alluvial type.

The unsatisfactory results of the 15-per-cent. sodium bisulphite sprayed on flowering ragwort at the Hutt, compared with the 95-per-cent. kill obtained with similar treatment five weeks earlier, suggests that this class of chemical is unsuitable for treating mature ragwort.

Mr. Taylor had a similar unsuccessful experience at Rotorua on flowering ragwort in January, but the treatment was quite satisfactory on small plants still in the rosette stage. However, the good kills obtained from another treatment late in February, following some weeks of heavy rain, led him to believe that the variations in the results were due to differences in the weather conditions and not the stage of growth.

From our experience it would not be advisable to spray ragwort in flower, owing to the danger of the seed being previously set and remaining viable after the treatment. If the infested pasture were grazed as closely as possible before spraying, less protection would be afforded young ragwort plants by the grass and any damage to the pasture minimized.

#### CONSIDERATIONS REGARDING COSTS OF TREATMENTS.

It is very difficult to estimate the costs per acre using bisulphites as weed-killers because the quoted prices are for the ordinary technical products. For weed-killing purposes the chemicals need not be so refined, and the manufacturing processes could probably be simplified to procure a cruder grade of material at a lower price. This applies particularly to potassium bisulphite, which, owing to the method of manufacture, is obtained in the pure crystalline form costing about £50 per ton c.i.f.e. New Zealand ports. However, the manufacturers mentioned that if it were successful for weed-killing purposes, "no doubt a satisfactory way of obtaining a commercial product might possibly be found." The quoted price of approximately £17 per ton for sodium bisulphite, also landed in New Zealand, is for the ordinary commercial product, but here again the manufacturers mentioned that a cruder grade could perhaps be made at a lower price. As already stated, the sodium ammonium salt was made only for the experimental purposes, and apparently is not sold commercially, although it should not cost a great deal more than the sodium bisulphite. It is not considered suitable, for so far it has not proved to be successful.

From the foregoing remarks it should be obvious that the cost of bisulphite treatment for ragwort cannot be ascertained till there is sufficient demand for the materials to enable the manufacturers to produce a suitable grade for weed-killing purposes at a lower price.

However, it should be stressed that the sodium bisulphite could be retailed at the principal ports at approximately 3d. a pound, while the prices of sodium chlorate and ammonium thiocyanate vary from round about 4½d. to 6d.,\* and 6d. to 8d. per pound respectively, according to the quantities purchased. This means that 10-per-cent. and 15-per-cent. solutions of sodium bisulphite would be no more expensive than, say, 5-per-cent. to 7½-per-cent. solutions of the other two chemicals. If a 7½-per-cent. solution of sodium bisulphite were found to be effective, as has been suggested by the Rotorua experiments, the cost would probably be very close to the cheapest effective solutions of either sodium chlorate or ammonium thiocyanate. A reduction could be made in the cost of potassium bisulphite to allow for the fertilizing-value of the potash.

To sum up, the Lower Hutt experiments have shown that, quite apart from considerations of price and properties of materials, including fertilizing-values, solutions of 10-per-cent. ammonium thiocyanate, 5-per-cent. sodium chlorate, 15-per-cent. sodium bisulphite, and 10-per-cent. and 15-per-cent. potassium bisulphite are approximately equally efficient for ragwort killing. At Rotorua it was considered that 5-per-cent. sodium chlorate was slightly superior, 10-per-cent. sodium and potassium bisulphites occupied an intermediate position, while 5-per-cent. and 10-per-cent. ammonium thiocyanate take third place, the superiority of the chlorate over the other two classes of chemical being very small indeed.

The unsuccessful results of the Miramar experiments suggest that further trials and more definite information will be required before recommendations can be given for the practical application of bisulphites treatment for ragwort extermination.

\* Sodium chlorate is landed in the stores of the main New Zealand ports for about 5d. per pound. There is a Government subsidy of 1d. per pound, and thus it is possible to sell large quantities of the material for 4½d. per pound. All the prices mentioned exclude freight within New Zealand, hence the cost in inland districts may be considerably greater.

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## PELARGONIUM - RUST.

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PELARGONIUM-RUST (*Puccinia pelargonii-zonalis*) is restricted to the cultivated geranium (*Pelargonium zonale* l'Herit), on which it is common in New Zealand. The causative organism has been recorded from South Africa, France, and Australia, and was first recorded in New Zealand in 1923.\*

### SYMPTOMS.

Infected plants are characterized by leaf spotting and premature leaf-fall (Fig. 3). The first symptom of the disease is the appearance of a pale yellow green spot about  $\frac{1}{16}$  in. in diameter on the upper surface of the leaf. The spot increases in size, almost immediately becoming visible on the lower surface where the central area ruptures, revealing

\* CUNNINGHAM, G. H. (1923): *Trans. N.Z. Institute*, Vol. 54, pp. 619-704.  
Cunningham, C. H. (1931.) *The Rust Fungi of New Zealand*, xx + 261 pp.

a powdery chocolate-brown tuft of spores surrounded by a light-coloured "halo" area. As the chlorotic area increases in size further pustules erupt near the periphery. These coalesce, forming a spore-bearing ring about the original pustule and separated from the healthy tissue by a narrow "halo." Following heavy infection, the leaf turns



FIG. 1. TYPICAL RUST-INFECTION ON A PELARGONIUM LEAF (TELEUTOSPORIAL STAGE).

X 1.

[Photo by E. B. Levy.

yellow and the infected portions appear as green spots. The spore-bearing areas eventually acquire a dark brown to black shiny surface.

Though unusual, a small tuft of spores occasionally develops on the upper surface of the leaf in the centre of an infection spot. The rust also produces spore-bearing rings on bracts, and attacks leaf-stalks and petioles, producing powdery longitudinal pustules half an inch or more in length.

## LIFE-HISTORY AND MORPHOLOGY OF THE FUNGUS.

Pelargonium rust is caused by *Puccinia pelargonii-zonalis* Doidge,\* a rust fungus having only uredospores and teleutospores in its life-cycle. At present the function of the teleutospores is not understood, and the organism appears to be perpetuated by air-borne uredospores, which are produced on infected plants throughout the year.

A spore may alight on a geranium leaf, and if conditions are suitable it germinates, producing from a germ-pore an infection hypha, which enters the leaf-tissues. Here the hypha branches, ramifying between the host-cells and ultimately producing a compact mass of mycelium beneath the lower epidermis. From this mycelium arises a columnar tissue of conidiophores, from the apices of which uredospores are formed. The pressure exerted by the developing uredospores ruptures the epidermis of the leaf and thus releases the spores. Uredospores are produced while the leaf remains green, but as it withers teleutospores are formed in their stead. These persist as a single layer over the spore-bearing surface after the leaf falls.

## EXPERIMENTS ON CONTROL.

Experiments to test the efficacy of sulphur sprays on the control of pelargonium-rust were carried out in two series (a) in the glass-house,† and (b) outdoors.

(a) In the former series‡ naturally infected potted plants were used. Each spray treatment was applied to two pots, and five pots remained unsprayed as checks. The unsprayed plants were so placed that spores liberated from them would fall on the sprayed plants. Sprays were applied at weekly intervals from 6th April until 25th May, 1932. The spray treatments and the effects on rust infection are recorded in Table I.

Table I.—Spraying Glasshouse Pelargoniums for Rust-control.

| Treatment.                                  | Total Number of Leaves. | Total Number of Sori. | Average Number of Sori per Leaf. |
|---------------------------------------------|-------------------------|-----------------------|----------------------------------|
| Precipitated sulphur 10 lb. per 100 gallons | 24                      | 104                   | 4.3                              |
| Precipitated sulphur 20 lb. per 100 gallons | 8                       | 20                    | 2.5                              |
| Colloidal sulphur 2 lb. per 100 gallons ..  | 15                      | 55                    | 3.6                              |
| Colloidal sulphur 4 lb. per 100 gallons ..  | 20                      | 23                    | 1.2                              |
| Lime-sulphur 0.083 per cent. polysulphides  | 42                      | 36                    | 0.9                              |
| Lime-sulphur 0.1 per cent. polysulphides    | 18                      | 12                    | 0.6                              |
| No spray (check) .. ..                      | 53                      | 2,582                 | 48.7                             |

In the glasshouse the best control was given by lime-sulphur sprays, particularly that containing 0.083-per-cent. polysulphides. (The 0.1-per-cent. polysulphide spray caused leaf scorch.) Both colloidal and precipitated sulphur sprays reduced infection considerably, but left prominent deposits on the leaves.

\* DOIDGE, ETHEL M. (1926): *Bothalia*, Vol. 2, p. 98.

† During these experiments it was noticed that plants raised in an isolated glasshouse from infected cuttings stripped of leaves and washed under a tap before planting did not become infected during the eighteen months they were under observation.

‡ Thanks are due to Mrs. C. E. Purton, of Palmerston North, who made available the plants and glasshouse used in this experiment.



FIG. 2. LEAF SECTION SHOWING RUST PUSTULE. X 150.

*u* = uredospores; *t* = teleutospores; *c* = conidiophores.

[Original.]



FIG. 3. UNSPRAYED (CHECK) PLANTS AT CONCLUSION OF GLASSHOUSE EXPERIMENT.

[Photo by H. Drake.]

(b) In the outdoor experiments lime-sulphur and colloidal sulphur were applied at weekly intervals from the 8th December, 1933, until the 13th April, 1934. Unsprayed plants were grown 4 ft. from the sprayed to serve as checks. Counts of infected leaves were made at the conclusion of the experiment and the results are tabulated in Table 2.



FIG. 4. PLANTS SPRAYED WITH LIME-SULPHUR AT CONCLUSION OF EXPERIMENT.

[Photo by H. Drake.]

Table 2.—*Spraying Outdoor Pelargoniums for Rust-control.*

| Treatment.                                 | Number of Plants. | Leaves present. |       |        | Leaves infected. |       |        | Per Cent. of Leaves infected. | Number of Sori. |
|--------------------------------------------|-------------------|-----------------|-------|--------|------------------|-------|--------|-------------------------------|-----------------|
|                                            |                   | Green.          | Dead. | Total. | Green.           | Dead. | Total. |                               |                 |
| Colloidal sulphur 2 lb. per 100 gallons    | 4                 | 526             | ..    | 526    | ..               | ..    | ..     | ..                            | ..              |
| Colloidal sulphur 4 lb. per 100 gallons    | 4                 | 650             | 64    | 714    | ..               | ..    | ..     | ..                            | ..              |
| Lime-sulphur 0.083-per-cent. polysulphides | 3                 | 427             | 98    | 525    | 18               | ..    | 18     | 3.4                           | 31              |
| Lime-sulphur 0.1-per-cent. polysulphides   | 4                 | 507             | 104   | 611    | 21               | ..    | 21     | 3.4                           | 41              |
| Check (unsprayed) ..                       | 4                 | 596             | 291   | 887    | 359              | 195   | 554    | 66.0                          | *               |
| Check (unsprayed) ..                       | 4                 | 509             | 147   | 656    | 255              | 127   | 382    | 57.0                          | *               |

\* In these cases sori were extremely numerous.

Outdoors complete control was secured with colloidal sulphur sprays at 2 lb. and 4 lb. per 100 gallons. A small amount of infection developed on the plants sprayed with lime-sulphur. As in the glasshouse, 0.1-per-cent. polysulphides again caused leaf-scorch.

#### CONSIDERATIONS AFFECTING CONTROL AND CONTROL-MEASURES.

Pelargonium rust is initiated by wind-borne spores which, given favourable conditions, may cause infection of any geranium plant on which they alight. The disease overwinters on plants in sheltered positions about the garden and on cuttings in the glasshouse.

To prevent the disease:—

(1) Plants in sheltered positions should be pruned rigorously during the late autumn and the diseased material burned. They should be sprayed after pruning with 2 lb. colloidal sulphur per 100 gallons ( $\frac{3}{4}$  oz. per  $2\frac{1}{2}$  gallons).

(2) The leaves and bracts of cuttings should be removed and the stems washed thoroughly under a tap.

(3) When the disease appears in the glasshouse, plants should be sprayed at weekly intervals with lime-sulphur containing 0.083-per-cent. polysulphides, or, if outdoors, with 2 lb. of colloidal sulphur per 100 gallons.

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## TESTING OF PUREBRED DAIRY COWS.

### REVIEW OF THE NEW ZEALAND CERTIFICATE-OF-RECORD SYSTEM IN 1935.

W. M. SINGLETON, Director of the Dairy Division, Wellington.

A SURVEY of the result of certificate-of-record testing for the calendar year 1935 in comparison with 1934 indicates a marked falling-off in the number of certificates issued, while there were fewer outstanding individual performances. The reasons are not far to seek. Entries for the period under review were made in the late winter and early spring of 1934 when the dairying outlook was by no means promising, and breeders of pedigree dairy cattle no doubt felt disinclined to commit themselves to the comparatively high cost involved in certificate-of-record testing. The long dry summer and autumn of 1934-35 prevented many cows from attaining the yield of which they would have been capable under more normal climatic conditions. First-class certificates-of-record were issued to 554 cows in 1935, as compared with 637 cows in 1934, 450 cows being in the yearly-test division and the remaining 104 in the 305-day division, the comparative figures for 1934 being 534 and 103 respectively.

#### (1) C.O.R. YEARLY TEST DIVISION.

The 450 certificates issued during the year represented an average production of 516.3 lb. butterfat, a decrease of 11.15 lb. over the 1934 average of 527.45 lb. fat for 536 certificates. (In 1934 two cows each received two certificates, which accounts for the difference of two between the number of cows and number of certificates for that year.)

## FIRST-CLASS CERTIFICATES ISSUED.

The total number of cows which have been granted first-class certificates since the inception of the certificate-of-record system in 1912 has now reached 9,428. Subdivided into breeds this total represents 6,914 Jerseys, 1,764 Friesians, 453 Milking Shorthorns, 219 Ayrshires, 68 Red Polls, 2 Guernseys, and 8 Shorthorns. Table 1 provides a numerical summary of yearly certificates of the first class issued during the past two years:—

Table 1.

| Breed.              | 1935.     |         |        | 1934.     |         |        |
|---------------------|-----------|---------|--------|-----------|---------|--------|
|                     | Ordinary. | Repeat. | Total. | Ordinary. | Repeat. | Total. |
| Jersey .. ..        | 352       | 28      | 381    | 415       | 41      | 456    |
| Friesian .. ..      | 44        | 12      | 56     | 41        | 18      | 59     |
| Milking Shorthorn.. | 10        | ..      | 10     | 9         | 3       | 12     |
| Ayrshire .. ..      | 1         | ..      | 1      | 2         | ..      | 2      |
| Shorthorn .. ..     | 1         | ..      | 1      | ..        | ..      | ..     |
| Red Poll .. ..      | ..        | 1       | 1      | 6         | 1       | 7      |
| Totals .. ..        | 409       | 41      | 450    | 473       | 63      | 536    |

## SECOND-CLASS CERTIFICATES ISSUED.

Twenty-four second-class certificates were issued during the year, 18 being gained by Jerseys, 5 by Friesians, and 1 by a Milking Shorthorn. The previous year's total was 35. In the past year the average production of the 18 Jerseys was 555.27 lb. fat, the 5 Friesians averaged 515.28 lb., while the 1 Milking Shorthorn was credited with 566.28 lb. fat.

## THIRD-CLASS CERTIFICATES.

Third-class certificates issued during the year numbered 140, comprising 74 Jerseys, 64 Friesians, and 2 Milking Shorthorns. The average of the Jerseys was 495.09 lb. fat from 8,866.8 lb. milk in 355 days, for the Friesians 583.13 lb. fat from 16,763.9 lb. milk in 353 days, while the 2 Milking Shorthorns averaged 347.42 lb. fat from 8,185.8 lb. milk in 365 days. With regard to third-class certificates it should be explained that this classification is of recent origin, having been in existence for only three years. Breeders have been given an opportunity to obtain certificates on records made in past years and for cows hitherto regarded as unqualified. Of the 64 Friesian certificates granted last year, 41 related to performances made in earlier years. Any cow which qualifies for first- or second-class certificate in all respects save subsequent calving is entitled to receive a third-class C.O.R.

## PERIOD BETWEEN CALVING.

The average period between calving for commencement of test and calving subsequent to test for the 450 cows granted first-class certificates in 1935 was 404 days, as compared with 403 days for the preceding

year. The corresponding period for the second-class cows was 463 days, which is the same as for 1934. The rules governing the testing provide for a maximum period between calvings of 455 days for first-class certificate and 485 days for second-class C.O.R. It is therefore interesting to note that last year the average cow qualifying for first-class certificate calved fifty-one days within the period allowed, while the second-class cows failed for their first-class certificates by eight days.

## JERSEYS.

### *Class Leaders.*

No changes took place in the Jersey class leaders during the year. The highest Jersey for 1935 was Coniston Goldie, owned by Mr. R. Waterhouse, of Takanini. Commencing test at the age of 5 years 330 days, Coniston Goldie gained a certificate for 13,579·3 lb. milk containing 918·96 lb. fat in 365 days. This is certainly an outstanding cow, and on her performance as a junior two-year-old was at one time leader of that class on a record of 742·71 lb. fat. The present Jersey class leaders are as follows:—

Table 2.

| Name of Cow and Class.                                 | Tested by                        | Age at Start of Test. | Fat required for Certificate. | Yield for Season. |          |             |
|--------------------------------------------------------|----------------------------------|-----------------------|-------------------------------|-------------------|----------|-------------|
|                                                        |                                  |                       |                               | Days.             | Milk.    | Butter-fat. |
| <i>Junior Two-year-old.</i><br>Beechlands Summer Lass  | A. Moreland and Sons,<br>Te Rapa | Yrs. dys.<br>1 343    | lb.<br>275·5                  | 365               | 15,467·2 | 899·25      |
| <i>Senior Two-year-old.</i><br>Ivondale Golden Rainbow | P. J. Petersen, Waitara          | 2 311                 | 271·6                         | 365               | 12,962·2 | 768·46      |
| <i>Three-year-old.</i><br>Ivondale Silver Rainbow      | P. J. Petersen, Waitara          | 3 327                 | 309·7                         | 365               | 15,073·4 | 950·63      |
| <i>Four-year-old.</i><br>Woodlands Felicie             | P. J. Petersen, Waitara          | 4 364                 | 384·9                         | 365               | 17,332·6 | 1,220·89    |
| <i>Mature.</i><br>Holly Oak's Annie.                   | W. T. Williams,<br>Pukehou       | 5 9                   | 350·0                         | 365               | 18,522·7 | 1,056·49    |

### *Jersey Class Averages.*

The number of certificates issued to Jerseys in the yearly division declined from 456 in 1934 to 381 in 1935. The average production represented by those 381 certificates was 511·73 lb. butterfat, being some 6·29 lb. less than the previous year's average of 518·02. A study of the results according to age class indicates that the falling-off occurred



FIG. 1. CONISTON GOLDIE (R. WATERHOUSE, TAKANINI).

Highest C.O.R. Jersey, 1935; age, 5 years 330 days: 13,579.3 lb. milk, 918.96 lb. butterfat.



FIG. 2. HUA BROOK PERFECT LADY (H. SALWAY, BELL BLOCK).

New class leader in mature class, 305-day test division: 12,837.1 lb. milk, 676.13 lb. butterfat.

*"N.Z. Dairy Exporter" photo.*

principally in the junior two-year-olds, all other classes except the four-year-old showing an increase. The averages class by class for 1935 and 1934 are given in Table 3:—

Table 3.

| Class.                 | Number of Cows. | Average Yield for Season. |          |            |
|------------------------|-----------------|---------------------------|----------|------------|
|                        |                 | Days in Milk.             | Milk.    | Butterfat. |
| 1935.                  |                 |                           | lb.      | lb.        |
| Junior two-year-old .. | 166             | 360                       | 7,990.5  | 455.34     |
| Senior two-year-old .. | 40              | 357                       | 8,988.7  | 499.60     |
| Three-year-old ..      | 60              | 361                       | 9,994.1  | 560.23     |
| Four-year-old ..       | 42              | 356                       | 9,900.5  | 564.92     |
| Mature ..              | 73              | 358                       | 10,435.2 | 576.13     |
| 1934.                  |                 |                           |          |            |
| Junior two-year-old .. | 188             | 360                       | 8,246.7  | 473.65     |
| Senior two-year-old .. | 46              | 356                       | 8,442.2  | 492.32     |
| Three-year-old ..      | 60              | 359                       | 9,439.1  | 540.59     |
| Four-year-old ..       | 47              | 355                       | 9,868.9  | 566.31     |
| Mature ..              | 115             | 355                       | 10,239.6 | 569.31     |

The averages, class by class, of all certificates issued to Jersey cows since the commencement of the C.O.R. system in 1912 are given in Table 4:—

Table 4.

| Class.                       | Number of<br>Certificates. | Average Yield for Season. |         |            |
|------------------------------|----------------------------|---------------------------|---------|------------|
|                              |                            | Days in Milk.             | Milk.   | Butterfat. |
|                              |                            |                           | lb.     | lb.        |
| Junior two-year-old ..       | 3,113                      | 349                       | 7,234.6 | 407.17     |
| Senior two-year-old ..       | 826                        | 346                       | 7,929.1 | 447.92     |
| Three-year-old ..            | 1,153                      | 346                       | 8,672.6 | 485.28     |
| Four-year-old ..             | 799                        | 348                       | 9,231.6 | 515.96     |
| Mature ..                    | 1,883                      | 347                       | 9,564.6 | 526.45     |
| All ..                       | 7,774                      | 347                       | 8,291.3 | 463.16     |
| Average test, 5.58 per cent. |                            |                           |         |            |

### *Jersey C.O.R. Bulls.*

Our list of Jersey bulls which have sired C.O.R. cows now includes 2,522 names, and of these 510 have qualified for the C.O.R. bull class. A bull is classed as a C.O.R. bull when he has four or more daughters with first-class certificates, each daughter being from a different dam. Thirty-three bulls have now qualified for the Jersey Cattle Breeders' Association's champion butterfat bull class, the qualifications for this class being as follows: Each bull must have five or more daughters which under first-class C.O.R. conditions have produced 520 lb. butterfat when starting test up to three years of age, 580 lb. when starting between three and four years of age, 640 lb. when starting between four and five years of age, or 700 lb. when five years old or over. It is not necessary for each daughter to be from a different dam. (The corresponding standards for cows in the 305-day test are 460 lb., 510 lb., 560 lb., and 620 lb. butterfat respectively.)

### Friesians.

#### *Class Leaders.*

None of the Friesian performances of the past year seriously challenged the class leaderships. Credit for the highest Friesian record for 1935 goes to Paepaetahi Michaelmas Rosebud, a six-year-old cow owned by Mr. A. F. Perkins, of Taradale, Hawke's Bay, and which gained a certificate for 900.43 lb. fat from 22,815.9 lb. milk in 365 days. It is also desired to place on record the gaining of another certificate by Totara C.R. Buttercup, bred and tested by the Piri Land Co., Auckland.



FIG. 3. PAEPAETAHI MICHAELMAS ROSEBUD (A. F. PERKINS, TARADALE).  
Highest C.O.R. Friesian, 1935 : 22,815.9 lb. milk, 900.43 lb. butterfat.

Unfortunately this was a third-class C.O.R., the cow's production being 879.06 lb. fat, making an average of 957.60 lb. fat for five successive lactations. Her individual records to the end of 1935 are as follows :—

#### *Totara C.R. Buttercup.*

| Age.    |      | Days. | Milk.    | Fat.     |
|---------|------|-------|----------|----------|
| Yrs.    | dys. |       | lb.      | lb.      |
| 2       | 205  | 365   | 21,208.6 | 790.66   |
| 3       | 247  | 365   | 25,885.3 | 989.10   |
| 4       | 267  | 365   | 27,108.1 | 1,079.14 |
| 5       | 308  | 365   | 28,073.0 | 1,050.07 |
| 7       | 9    | 365   | 23,622.6 | 879.06*  |
| Average |      | 365   | 25,179.5 | 957.60   |

\* Third-class C.O.R.

Totara C.R. Buttercup is now on test for her sixth successive lactation, and her yield to date indicates that she will eclipse her last year's performance, which was made under the severe handicap of a most unfavourable season climatically.

The Friesian class leaders are as follows :—

Table 5.

| Name of Cow and Class.                                 | Tested by               | Age at Start of Test. | Fat required for Certificate. | Yield for Season. |          |            |
|--------------------------------------------------------|-------------------------|-----------------------|-------------------------------|-------------------|----------|------------|
|                                                        |                         |                       |                               | Days.             | Milk.    | Butterfat. |
| <i>Junior Two-year-old.</i><br>Monavale Queen Bess     | T. H. Richards, Cardiff | Yrs. dys.             | lb.                           |                   | lb.      | lb.        |
|                                                        |                         | 2 16                  | 242.1                         | 365               | 20,501.1 | 740.50     |
| <i>Senior Two-year-old.</i><br>Pareora Echo Blossom    | T. Sheriff, Clandeboyce | 2 223                 | 262.8                         | 365               | 22,671.9 | 819.81     |
| <i>Junior Three-year-old.</i><br>Monavale Queen Bess   | T. H. Richards, Cardiff | 3 56                  | 282.6                         | 365               | 21,609.3 | 800.18     |
| <i>Senior Three-year-old.</i><br>Totara C.R. Buttercup | Piri Land Co., Auckland | 3 247                 | 336.7                         | 365               | 25,885.3 | 989.10     |
| <i>Junior Four-year-old.</i><br>Totara Veeman Lulu     | Piri Land Co., Auckland | 4 12                  | 349.7                         | 365               | 22,364.2 | 946.78     |
| <i>Senior Four-year-old.</i><br>Totara C.R. Buttercup  | Piri Land Co., Auckland | 4 267                 | 375.2                         | 365               | 27,108.1 | 1,079.14   |
| <i>Mature.</i><br>Alcartra Clothilde Pietje            | Vernon Marx, Mangatoki  | 7 355                 | 350.0                         | 365               | 31,312.5 | 1,145.24   |

### Friesian Class Averages.

The number of cows of this breed which received certificates in the yearly division in 1935 was 56, compared with 59 for the preceding twelve months. In keeping with the general position, average production declined, being 622.87 for 1934 and 563.95 for the period under review. The Friesian class averages for 1935 and 1934 are as follows :—

Table 6.

| Class.                   | Number of Cows. | Average Yield for Season. |          |            |
|--------------------------|-----------------|---------------------------|----------|------------|
|                          |                 | Days in Milk.             | Milk.    | Butterfat. |
|                          |                 | 1935.                     | lb.      | lb.        |
| Junior two-year-old ..   | 18              | 365                       | 13,446.5 | 479.04     |
| Senior two-year-old ..   | 5               | 365                       | 13,927.4 | 516.54     |
| Junior three-year-old .. | 2               | 365                       | 16,880.7 | 691.17     |
| Senior three-year-old .. | 7               | 321                       | 15,773.9 | 550.08     |
| Junior four-year-old ..  | 3               | 336                       | 17,719.2 | 583.43     |
| Senior four-year-old ..  | 5               | 334                       | 16,429.7 | 587.15     |
| Mature .. ..             | 16              | 350                       | 17,281.1 | 653.57     |
|                          |                 | 1934.                     |          |            |
| Junior two-year-old ..   | 14              | 363                       | 13,867.5 | 493.01     |
| Senior two-year-old ..   | 9               | 365                       | 15,257.4 | 563.57     |
| Junior three-year-old .. | 7               | 365                       | 17,577.3 | 632.50     |
| Senior three-year-old .. | 5               | 358                       | 17,851.5 | 685.89     |
| Junior four-year-old ..  | 4               | 330                       | 15,868.0 | 561.55     |
| Senior four-year-old ..  | 3               | 356                       | 18,965.2 | 674.62     |
| Mature .. ..             | 17              | 352                       | 20,212.7 | 744.10     |

The averages, class by class, of all certificates issued to Friesian cows since the commencement of the C.O.R. system in 1912 are given in the following table:—

Table 7.

| Class.                       | Number of Certificates. | Average Yield for Season. |          |            |
|------------------------------|-------------------------|---------------------------|----------|------------|
|                              |                         | Days in Milk.             | Milk.    | Butterfat. |
|                              |                         |                           | lb.      | lb.        |
| Junior two-year-old ..       | 656                     | 347                       | 11,941·6 | 424·46     |
| Senior two-year-old ..       | 271                     | 348                       | 12,822·9 | 457·08     |
| Junior three-year-old ..     | 193                     | 343                       | 13,584·9 | 479·46     |
| Senior three-year-old ..     | 198                     | 337                       | 14,167·7 | 508·53     |
| Junior four-year-old ..      | 137                     | 345                       | 15,333·5 | 542·63     |
| Senior four-year-old ..      | 136                     | 347                       | 16,215·2 | 568·68     |
| Mature .. ..                 | 598                     | 343                       | 16,177·5 | 570·71     |
| All .. ..                    | 2,189                   | 344                       | 14,031·9 | 497·26     |
| Average test, 3·54 per cent. |                         |                           |          |            |

### Friesian C.O.R. Bulls.

Three new names were added to the Friesian C.O.R. bull list during the year, the total now being 120. Some 632 sires are represented in the 1,795 Friesian cows (including the 305-day division) certificated to the end of 1935.

### Milking Shorthorns.

#### Class Leaders.

One change took place in the Milking Shorthorn class leaders during the year, this occurring in the senior two-year-olds, in which class Messrs. Ranstead Bros.' Matangi Quality 5th, with 542·66 lb. fat, gives place to Messrs. G. D. Hall and Son's Pinedale Beauty 4th, with 580·62 lb. fat. Credit for the highest performance of the year goes to Allandale Lady Clare, owned by Messrs. R. S. Allan and Son, Hatuma, her record being 17,147·1 lb. milk containing 705·93 lb. fat in 365 days on a test commenced at 3 years 337 days old. The Milking Shorthorn class leaders are now as follows:—

Table 8.

| Name of Cow and Class.        | Tested by                         | Age at Start of Test. | Fat required for Certificate. | Yield for Season. |            |            |
|-------------------------------|-----------------------------------|-----------------------|-------------------------------|-------------------|------------|------------|
|                               |                                   |                       |                               | Days.             | Milk.      | Butterfat. |
| <i>Junior Two-year-old.</i>   |                                   | <i>Yrs. dys.</i>      | <i>lb.</i>                    |                   | <i>lb.</i> | <i>lb.</i> |
| Matangi Quality 4th. .        | Ranstead Bros., Matangi           | 2 109                 | 251·4                         | 365               | 14,572·8   | 591·89     |
| <i>Senior Two-year-old.</i>   |                                   |                       |                               |                   |            |            |
| Pinedale Beauty 4th           | G. D. Hall and Son, Otorohanga    | 2 362                 | 311·7                         | 365               | 13,273·0   | 580·62     |
| <i>Junior Three-year-old.</i> |                                   |                       |                               |                   |            |            |
| Matangi Quality 4th. .        | Ranstead Bros., Matangi           | 3 153                 | 292·3                         | 365               | 16,281·4   | 678·02     |
| <i>Senior Three-year-old.</i> |                                   |                       |                               |                   |            |            |
| Matangi Ruth 2nd ..           | Ranstead Bros., Matangi           | 3 304                 | 307·4                         | 365               | 14,032·7   | 747·86     |
| <i>Junior Four-year-old.</i>  |                                   |                       |                               |                   |            |            |
| Matangi Matilda 4th. .        | Hon. Mrs. E. J. Blyth, Kohimarama | 4 0                   | 313·5                         | 358               | 14,640·2   | 630·38     |
| <i>Senior Four-year-old.</i>  |                                   |                       |                               |                   |            |            |
| Ashley Bank Winsome           | Peach Bros., Sefton               | 4 298                 | 378·3                         | 365               | 17,687·7   | 730·93     |
| <i>Mature.</i>                |                                   |                       |                               |                   |            |            |
| Glenthorpe Lady ..            | A. J. Melville, Buckland          | Mature                | 350·0                         | 365               | 20,136·2   | 856·85     |

*Milking Shorthorn Class Averages.*

Ten cows of this breed received certificates in 1935, being two less than in 1934. Their average production was 465.78 lb. fat from 10,863 lb. milk in an average milking-period of 353 days. Two of the cows were in the junior two-year-old class, three in the senior two-year-old, two in the junior three-year-old, and one each in the senior three-year-old, senior four-year-old, and mature class.



FIG. 4. ALLLENDALE LADY CLARE (R. S. ALLAN AND SON, HATUMA).  
Highest C.O.R. Milking Shorthorn, 1935: 17,147.1 lb. milk, 705.93 lb. butterfat.

The averages, class by class, of all certificates issued to Milking Shorthorn cows since the commencement of C.O.R. testing for this breed in 1914 are given in the following table:—

*Table 9.*

| Class.                       | Number of<br>Certificates. | Average Yield for Season. |          |            |
|------------------------------|----------------------------|---------------------------|----------|------------|
|                              |                            | Days in Milk.             | Milk.    | Butterfat. |
|                              |                            |                           | lb.      | lb.        |
| Junior two-year-old ..       | 56                         | 348                       | 8,395.0  | 345.59     |
| Senior two-year-old ..       | 43                         | 350                       | 9,042.0  | 376.90     |
| Junior three-year-old ..     | 28                         | 336                       | 9,596.2  | 388.98     |
| Senior three-year-old ..     | 32                         | 344                       | 10,999.8 | 457.26     |
| Junior four-year-old ..      | 26                         | 350                       | 11,097.5 | 454.38     |
| Senior four-year-old ..      | 34                         | 343                       | 11,623.3 | 462.59     |
| Mature .. ..                 | 280                        | 341                       | 11,807.0 | 473.01     |
| All .. ..                    | 499                        | 343                       | 10,960.5 | 443.02     |
| Average test, 4.04 per cent. |                            |                           |          |            |

*Milking Shorthorn C.O.R. Bulls.*

One Milking Shorthorn bull qualified for the C.O.R. class during the year, the total now being fifteen. Some 148 sires are represented in the 453 cows of this breed certificated to the end of 1935.

**Ayrshires.***Class Leaders.*

Only one Ayrshire qualified for first-class C.O.R. in 1935, her performance making no change in the class-leadership list for the breed, which is as follows:—

Table 10.

| Name of Cow and Class.                         | Tested by                   | Age at Start of Test. | Fat required for Certificate. | Yield for Season. |                 |               |
|------------------------------------------------|-----------------------------|-----------------------|-------------------------------|-------------------|-----------------|---------------|
|                                                |                             |                       |                               | Days.             | Milk.           | Butter-fat.   |
| <i>Two-year-old.</i><br>Fair Maid of Greenbank | W. Moore, Homebush          | Yrs. dys.<br>2 27     | lb.<br>243·2                  | 365               | lb.<br>12,281·3 | lb.<br>673·56 |
| <i>Three-year-old.</i><br>Maesgwyn Victoria .. | C. Morgan Williams, Kaiapoi | 3 250                 | 302·0                         | 365               | 16,507·7        | 646·98        |
| <i>Four-year-old.</i><br>Ivanhoe Fancy ..      | A. M. Weir, Menzies Ferry   | 4 308                 | 344·3                         | 365               | 14,207·7        | 713·93        |
| <i>Mature.</i><br>Floss of Braeside ..         | W. Moore, Homebush          | 7 287                 | 350·0                         | 365               | 20,305·5        | 832·72        |

*Ayrshire Class Averages.*

The averages, class by class, for all certificates issued to Ayrshire cows since the commencement of C.O.R. testing in 1912 are given in the following table:—

Table 11.

| Class.                       | Number of Certificates. | Average Yield for Season. |                |               |
|------------------------------|-------------------------|---------------------------|----------------|---------------|
|                              |                         | Days in Milk.             | Milk.          | Butterfat.    |
| Two-year-old .. ..           | 70                      | 346                       | ib.<br>8,997·0 | lb.<br>373·33 |
| Three-year-old .. ..         | 38*                     | 347                       | 10,043·0       | 414·16        |
| Four-year-old .. ..          | 27*                     | 346                       | 11,378·0       | 459·52        |
| Mature .. ..                 | 110*                    | 348                       | 11,942·9       | 485·96        |
| All .. ..                    | 245                     | 347                       | 10,744·3       | 439·73        |
| Average test, 4·09 per cent. |                         |                           |                |               |

\* No additions during 1935.

*Ayrshire C.O.R. Bulls.*

No further Ayrshire Bulls qualified for the C.O.R. class during the year, the total remaining at 11, while 124 sires are represented in the 221 Ayrshire cows (including the 305-day division) certificated to the end of 1935.

**Red Polls.***Class Leaders.*

One Red Poll cow was certificated during the year, this being in the mature class. There was no change in the list of class leaders, which remains as follows:—

*Table 12.*

| Name of Cow or Class.  | Tested by                         | Age at Start of Test. | Fat required for Certificate. | Yield for Season. |            |            |
|------------------------|-----------------------------------|-----------------------|-------------------------------|-------------------|------------|------------|
|                        |                                   |                       |                               | Days.             | Milk.      | Butterfat. |
| <i>Two-year-old.</i>   |                                   | <i>Yrs. dys.</i>      | <i>lb.</i>                    |                   | <i>lb.</i> | <i>lb.</i> |
| Wayward 6th B No. 1    | G. S. Young, West Plains          | 2 188                 | 259.3                         | 365               | 11,228.0   | 511.42     |
| <i>Three-year-old.</i> |                                   |                       |                               |                   |            |            |
| Dominion Gold Top      | Central Development Farm, Weraroa | 3 302                 | 307.2                         | 365               | 9,491.25   | 459.46     |
| <i>Four-year-old.</i>  |                                   |                       |                               |                   |            |            |
| Wayward 6th B No. 1    | G. S. Young, West Plains          | 4 297                 | 343.2                         | 365               | 13,290.0   | 580.05     |
| <i>Mature.</i>         |                                   |                       |                               |                   |            |            |
| Waihou Pip             | W. Jackson, Waihou                | 7 25                  | 385.0                         | 365               | 12,681.8   | 537.90     |

*Red Poll Class Averages.*

The averages, class by class, for all certificates issued to Red Poll cows since the commencement of C.O.R. testing for this breed in 1918 are as follows:—

*Table 13.*

| Class.                       | Number of Certificates. | Average Yield for Season. |            |            |
|------------------------------|-------------------------|---------------------------|------------|------------|
|                              |                         | Days in Milk.             | Milk.      | Butterfat. |
|                              |                         |                           | <i>lb.</i> | <i>lb.</i> |
| Two-year-old .. ..           | 42                      | 345                       | 7,560.6    | 336.21     |
| Three-year-old .. ..         | 16                      | 346                       | 7,905.1    | 349.63     |
| Four-year-old .. ..          | 8                       | 349                       | 9,806.8    | 430.72     |
| Mature .. ..                 | 26                      | 341                       | 10,501.0   | 443.67     |
| All .. ..                    | 92                      | 344                       | 8,646.8    | 377.13     |
| Average test, 4.36 per cent. |                         |                           |            |            |

*Red Poll C.O.R. Bulls.*

Twenty-seven different sires are represented in the sixty-nine cows of this breed (including one in the 305-day division) certificated to date. No new names were added to the Red Poll C.O.R. bull list during the year.

**(2) C.O.R. 305-DAY TEST DIVISION.**

First-class 305-day certificates issued during the year under review numbered 104, and of these 94 went to Jerseys, 8 to Friesians, and 2 to Ayrshires. In addition, 5 Jerseys were granted second-class certificates in the 305-day division.

## Jerseys.

## Class Leaders.

There was one change in the class leaders during the year. This occurred in the mature class, Mr. J. A. Mitchell's Perfection's Hopeful, with 664.51 lb. fat yielding place to Mr. H. Salway's Hua Brook Perfect Lady, which gained a certificate for 676.13 lb. fat. The class leaders are now as follows:—

Table 14.

| Name of Cow and Class.      | Tested by               | Age at Start of Test. | Fat required for Certificate | Yield for Season. |          |            |
|-----------------------------|-------------------------|-----------------------|------------------------------|-------------------|----------|------------|
|                             |                         |                       |                              | Days.             | Milk.    | Butterfat. |
| <i>Junior Two-year-old.</i> |                         | Yrs. dys.             | lb.                          |                   | lb.      | lb.        |
| Erinview Moss ..            | J. Murray, Woodville    | 2 25                  | 253.0                        | 305               | 10,294.0 | 576.44     |
| <i>Senior Two-year-old.</i> |                         |                       |                              |                   |          |            |
| Erinview Joan ..            | J. Murray, Woodville    | 2 339                 | 284.4                        | 305               | 10,130.1 | 607.08     |
| <i>Three-year-old.</i>      |                         |                       |                              |                   |          |            |
| Glendale Silver ..          | A. Montgomerie, Kawhata | 3 319                 | 318.9                        | 305               | 11,352.7 | 631.42     |
| <i>Four-year-old.</i>       |                         |                       |                              |                   |          |            |
| Hatchliffe Lady Gay ..      | H. J. Kaye..            | 4 60                  | 329.5                        | 305               | 10,619.9 | 664.49     |
| <i>Mature.</i>              |                         |                       |                              |                   |          |            |
| Hua Brook Perfect Lady      | H. Salway, Bell Block   | 6 5                   | 360.0                        | 305               | 12,837.1 | 676.13     |

## Jersey Class Averages.

The production averages according to age class of the ninety-four first-class certificates issued to cows of the Jersey breed during the year under review are given in Table 15. The average for all the cows was 421.41 lb. fat, and the average test 5.46 per cent.

Table 15.

| Class.                 | Number of Cows. | Average Yield for Season. |         |            |
|------------------------|-----------------|---------------------------|---------|------------|
|                        |                 | Days in Milk.             | Milk.   | Butterfat. |
|                        |                 | 1935.                     | lb.     | lb.        |
| Junior two-year-old .. | 35              | 300                       | 6,422.7 | 368.66     |
| Senior two-year-old .. | 15              | 300                       | 7,759.9 | 410.71     |
| Three-year-old ..      | 21              | 297                       | 8,190.0 | 438.01     |
| Four-year-old ..       | 6               | 293                       | 8,794.1 | 478.44     |
| Mature ..              | 17              | 300                       | 9,323.1 | 498.83     |

**Friesians.***Class Leaders.*

No changes took place in the Friesian list of class leaders for the 305-day division, the position remaining as follows:—

Table 16.

| Name of Cows and Class.                                          | Tested by                    | Age at Start of Test. | Fat required for Certificate. | Yield for Season. |          |             |
|------------------------------------------------------------------|------------------------------|-----------------------|-------------------------------|-------------------|----------|-------------|
|                                                                  |                              |                       |                               | Days.             | Milk.    | Butter-fat. |
| <i>Junior Two-year-old.</i><br>Sealands Magpie<br>Pietertje 2nd  | H. G. A. Cameron,<br>Weraroa | Yrs. dys.<br>2 22     | lb.<br>252.7                  | 305               | 11,727.4 | 454.16      |
| <i>Senior Two-year-old.</i><br>Rosevale Beauty Posch<br>Griselda | E. H. Watson, Windsor        | 2 216                 | 272.1                         | 305               | 12,273.5 | 468.50      |
| <i>Junior Three-year-old.</i><br>Totara De Kol Nina              | Piri Land Co., Auckland      | 3 117                 | 298.7                         | 305               | 16,005.9 | 501.37      |
| <i>Senior Three-year-old.</i><br>Sealands Alcartra<br>Fobes      | H. G. A. Cameron,<br>Weraroa | 3 304                 | 317.4                         | 305               | 10,407.8 | 389.04      |
| <i>Junior Four-year-old.</i><br>...                              | ...                          | ..                    | ..                            | ..                | ..       | ..          |
| <i>Senior Four-year-old.</i><br>Ellerlea Aaggie Segis<br>Minto   | C. H. Steadman, Pokapu       | 4 357                 | 359.2                         | 305               | 15,311.9 | 557.71      |
| <i>Mature.</i><br>Ellerlea Egie Segis<br>Minto                   | C. H. Steadman, Pokapu       | 6 345                 | 360.0                         | 305               | 16,303.1 | 650.85      |

*Friesian Class Averages.*

The average production of the eight Friesians gaining certificates during the year was 405.15 lb. fat from 11,422 lb. milk in 299 days.

**Ayrshires.***Ayrshire Class Averages.*

The average production of the two Ayrshires which gained certificates during the year was 296.59 lb. fat from 6,850.6 lb. milk in 305 days.

We desire to again place on record our appreciation of the co-operation of the Breeders' Associations which are connected with the C.O.R. testing. The success of the work is largely due to their practical assistance.

The Fields Division officer at Dargaville reports that a Matakohē farmer who last year went in extensively for running pigs on the small-paddock system has stated that he is definitely sure that the small-paddock system is not going to be satisfactory from a pasture point of view. In the one year that the pigs have been running in these paddocks rapid pasture-deterioration has taken place. He is trying to overcome this rapid deterioration by removing a number of sub-division fences and making the paddocks larger.

## FARMING IN THE AUCKLAND PROVINCE.

### OBSERVATIONS ON FARM-MANAGEMENT METHODS.

P. W. SMALLFIELD, Fields Superintendent, Auckland.

#### III. THE MIDDLE WAIKATO BASIN—*continued.*

##### THE THAMES VALLEY.

THE Thames Valley, the plains of the Piako and Waihou Rivers, is an area of flat alluvial land lying between the Colville Range on the east and the Maungakawa-Pakaroa-Hangawera-Pateroa Hills on the west; on the north it is bounded by the Firth of the Thames, and in the south by the Tokoroa Plain. The Maungakawa-Pakaroa Hills run from Mount Maungatautari to Morrinsville and divide the plains of the Waikato and Waipa from the plains of the Piako and Waihou; at Morrinsville there is a break in the hills, but they appear six miles to the north as the maturely sculptured Hangawera Hills. The plains consist of low undulating hills, flat areas of light and heavy alluvial soils, and large peat swamps.

Whilst the plains of the Waikato and Waipa were originally settled in comparatively small areas, the Thames Valley was first taken up in large holdings, and many people still remember Matamata, Waharoa, Lockerbie, Paeroa, Mangawhero, Okoroire, Mangapouri, and Waitoa Stations; when these and other stations were controlled by the Assets Realization Board, John McCaw, the general Superintendent, controlled properties having a total area of about 156,000 acres, carrying about 100,000 sheep and 12,000 cattle. It was an age of extensive farming, with short rotation pastures, cereal and root crops, beef cattle, and sheep. Carr Rollett (15) who visited Matamata Estate in 1889, wrote—

"Matamata at the time of my visit, including Waharoa, about 10,000 acres, part of which had just been leased in small areas to dairy-farmers, totalled 50,000 acres. No less than 22,000 acres were in grass, 2,000 acres in root crops, chiefly swedes and soft turnips, and 500 acres were in oats for threshing and chaffing; the balance was in scrub, fern, and undrained swamps. It carried 31,000 sheep, 2,600 cattle, and 184 horses. . . . Scrub was cut with a mower, the land ploughed, sown in temporary grass, mainly red clover, left down two to three years, then swedes, then pasture for six years, and then swedes, and down to grass for nine years. . . . I saw 20,000 sheep in one mob on 100 acres of turnips. . . . Between 13,000 and 14,000 sheep were driven during the season to Te Aroha and shipped on barges which held 700 to 1,000. Then they were towed down the river, through the Waiheke Channel, up the Tamaki River to Buckland's Farm. . . . Matamata was sold to the State a few years after my visit, the price paid being just under £3 per acre."

Matamata Estate was developed by the late Josiah Clifton Firth, and the Matamata venture must have appealed tremendously to a man of Firth's temperament:—

"A practical man, an idealist, a romanticist: to go into the wilderness and negotiate with Natives only one generation removed from cannibalism, and still smarting from the sense of the wrongs done them in Taranaki and the Waikato; to convert into a highway of traffic a river choked with obstructions throughout more than half its course; to bring into cultivation more than 40,000 acres of scrub waste, all swampy on its northern flank; to produce wheat enough for his mill and fat bullocks enough for half of old Auckland, and mutton and wool and cheese besides" (16).

Firth's extensive farming failed, as did that of other large stations, and as many have failed subsequently in developing light pumice soils in an extensive way. This land must be farmed intensively, and dairy-farming, with top-dressing and intensive methods of pasture-management, has been successful in turning the great stretch of pumice flats, formed by the Waikato when it entered the basin through the Hinuera Valley, into high-class pasture land.

The Hauraki Plains occupy the northern part of the Thames Valley, between the western hills and the Waihou River on the east, extending south from the Firth of the Thames a distance of about twenty-four miles. Prior to 1908 this large area was a morass, with the exception of a strip of land along the Waihou River. The Hauraki Plains Act, 1908, provided the legal machinery for the drainage and settlement of about 90,000 acres of Crown land. Three types of land were dealt with—viz., (a) mangrove flats; (b) alluvial flats, covered in raupo and kahikatea, lying between the Piako and Waihou Rivers as far as Kerepehi, thence by the Awaiti Stream to Netherton; (c) peat swamps, with the peat varying in depth from a few inches to forty feet. In draining the area improvements were made to the channel of the Piako River, a drainage channel was constructed to collect the surface run-off from the western hills, stop-banks were erected along the foreshore and rivers to prevent tidal and flood overflows, and an internal system of drainage canals was constructed and the area roaded: the total area covered by the drainage system is 160,000 acres.

Table V.—*Crops and Live-stock. Table showing Areas in Crops and Pasture and Numbers of Live-stock in Thames Valley Counties, 1933-34.\**

| County.        | Crops.        |          |                                 | Live-stock. |               |              |        |
|----------------|---------------|----------|---------------------------------|-------------|---------------|--------------|--------|
|                | Annual Crops. | Pasture. | Pasture cut for Hay and Silage. | Dairy Cows. | Other Cattle. | Sheep Shorn. | Pigs.  |
|                | Acres.        | Acres.   | Acres.                          |             |               |              |        |
| Hauraki Plains | 2,607         | 79,935   | 7,815                           | 40,060      | 16,889        | 6,117        | 13,707 |
| Piako          | 6,323         | 186,865  | 29,093                          | 91,423      | 45,119        | 81,308       | 31,902 |
| Matamata†      | 10,593        | 204,687  | 20,740                          | 70,948      | 41,638        | 87,038       | 28,525 |
|                | 19,523        | 471,487  | 57,648                          | 202,431     | 103,646       | 174,463      | 74,134 |

\* From Agricultural and Pastoral Statistics.

† Only the northern portion of the Matamata County is in the Thames Valley; figures are for the whole county.

Farming in the Thames Valley is generally similar to that on the plains of the Waikato and Waipa, dairying and fat-lamb raising are again the chief farming industries; farm-management on the Hauraki Plains presents some particular problems, but these will be discussed in the description of Hauraki Plains County. Piako County is the premier dairying county of New Zealand, for during the 1933-34 season it had 88,546 dairy cows in milk and 2,877 dry dairy cows on the 31st January, 1934, a total of 91,423 dairy cows.

## HAURAKI PLAINS COUNTY.

July 16th, 1935: *Waitakaruru-Pipiroa-Orongo*.—Just before reaching Waitakaruru I examined some recent pasture-sowings on the hills on the western edge of the Hauraki Plains. A manuka covering 5 ft. to 6 ft. high had been cut and burnt, the land disked and sown with a



FIG. 6. JOURNEY IN HAURAKI PLAINS, PIAKO, AND MATAMATA COUNTIES.

rye-grass - cocksfoot - white clover mixture. A fair grass and clover establishment had been obtained, but in places the sward was very thin, and manuka and bracken fern were coming back. There are two schools of thought in the preparatory cultivation of this scrub land for grass: some farmers maintain that the land should be ploughed before

grassing and others that surface disking gives the best results. A great deal depends on how the work is done, and really the grassing of these undulating hills should follow fairly closely the system used on the northern gum lands. It is all a matter of seed-bed—a thorough surface disking may give a better seed-bed than bad ploughing and poor after-cultivation, but if the ploughing and subsequent working are well done, and give a firm and moist seed-bed, the results are better than those obtained after surface-disking. Ploughing does away with manuka coming back, and this plant is often a real pest on surface-worked land. With surface working, a good clover establishment is usually obtained, because the seed-bed is firm underneath, but grass establishment is often weak, and with a poor grass establishment only light stocking is possible, and eventually fern and manuka come back. Areas on these western hills are used for winter “run off” country for dairy-farms on the plains, so that during June and July the dry cows can be moved off the wet land of the plains. In the past, heavy winter stocking has done a great deal of harm in poaching the heavy alluvial plains land; to overcome the poaching of the pasture-land in the neighbourhood of the milking-sheds, many farmers have made long, narrow concrete walks running out from the sheds to the various grazing fields—paths just wide enough for one cow to walk on.

The plains are looking particularly well for mid-July. There is a good rye-grass growth on the alluvial land and some small paddocks of prairie-grass are throwing a great deal of feed, but generally the dairy herds do not look as well as they do in other districts on lighter and drier land. Farming on the Hauraki Plains has its own particular problems: the heavy alluvial soils poach badly with winter stocking, and after a wet winter buttercup and pennyroyal are common pasture-weeds; the cows used to scour badly on the peat areas; special supplies of water have had to be provided, as the bore water is mineralized; and grassing has not been particularly successful on some of the littoral clays and deep-peat areas.

The littoral clays, which before stop-banking and drainage grew mangrove woods, occur at the northern end of the plains. Pasture depletion on these areas assumed serious proportions during the dry summer of 1928–29, but had probably been in progress for the previous five or six years. The depleted pastures lost practically all the pasture plants originally sown, and the land reverted to pennyroyal, curled dock, *Poa annua*, and buttercup; the only pasture plants that survived from the original pastures were isolated plants of *paspalum*, meadow foxtail, patches of *Poa pratensis*, and strawberry clover. The initial stage of deterioration was the dying of white clover, followed by rye-grass and cocksfoot. On some farms the grass went out in patches, on others a single field died out, and on other areas there was a gradual advance of the line of deterioration. During the past dry summer a certain amount of deterioration again occurred, and I visited a farm at Pipiroa where good use is being made of strawberry clover in overcoming the trouble. Where strawberry clover is growing, rye-grass is growing well also, but where strawberry clover is absent, the pastures have deteriorated to *Poa annua* and reversed clover. It is something the same as happens on dry land where white clover goes out, for

without white clover grasses do not flourish. Here on these littoral clays in dry seasons the saline conditions are unfavourable for white clover, hence it dies, but strawberry clover thrives, and with its deep-root system it keeps green in the summer, shades the surface soil, and rye-grass is maintained in a vigorous condition.

Tall fescue still occupies a considerable area of land at Orongo; in the past it has caused great farming difficulties, but areas are now being cleared and sown down in good rye-grass pastures. Cattle sickness is common on tall-fescue country; in the summer and early autumn cattle lose condition, the coat gets rough and the death-rate is high, whilst in the winter lameness is common—a leg, generally the left hind, swells from the hock or knee down, later gangrene sets in, the skin dies above the fetlock, and the foot drops off. On swamp lands that are really properly drained the eradication of tall fescue is not difficult provided the land is reasonably fertile. Drainage is essential, and if the land can be covered with a good sward of mixed grasses and clovers, which are controlled by grazing, tall fescue will not come back. In the eradication of tall fescue the standing growth is generally burnt, the tussocks grubbed and burnt, the land ploughed and sown in an annual crop or temporary pasture, and later sown to permanent grass. Some of the best tall-fescue eradication at Orongo was done by first pulling out the tall-fescue tussocks with a triangular harrow fitted with knife-edges (a road-grader was also used), the heaps of tussocks were burnt, the land ploughed and sown in rape, which was followed by a further rape crop, and the land then sown to permanent grass. At present there are a number of settlers at Orongo using maize as the annual cleaning crop; the land grows good maize crops, and the growing of a cash crop allows of economical fescue eradication. In other places other methods of eradication are used, but generally the best method is ploughing, and the use of annual smother or cleaning crops before the land is finally sown to grass.

*July 17th, 1935: Paeroa-Waitakaruru-Kaihere-Patetonga.*—A fine day, and the alluvial land along the rivers is everywhere showing a good grass-growth, but on the peat areas the growth is not generally as good. The alluvial soils near the rivers are the best land on the plains, and were covered originally in kahikatea, manuka, cabbage-trees, raupo, or flax, depending on the moisture conditions. At varying distances from the rivers peat overlies the alluvial deposits and varies in depth from a few inches to 40 ft. "Purua grass" (*Scirpus maritimus*) once covered a good deal of the peaty land near the rivers, and is still found in odd places; in the early days it provided much feed, it grows from small tubers and throws a luxuriant summer growth; on the deeper peat areas rushes formed the original covering(17).

In the reclamation of the Hauraki Plains a great deal of stop-banking and river-dredging, as well as drain-cutting, has been done. The channel of the Piako River has been improved, two extensive diversions of the river have been made, and the channel of the river widened. The flooding of the river has not been prevented altogether, but a large area of deep peat to the south of Kaihere is being utilized as a natural ponding-area, and this has the effect of retarding the flood-flow in the lower reaches of the river. The Maukoro Canal constructed from the sea at the mouth of the Waitakaruru Stream collects the water from

the western hills; the Awaite Canal drains the Awaite Basin and discharges into the Piako at Kerepeehi; the Ngarua Canal joins the Piako at Kaihere and provides the drainage for a large area of peat land. The stop-bank system commences on the foreshore of the Firth of the Thames and extends up both banks of the Piako as far as Kaihere; in addition, stop-banks have been erected on the Waitakaruru, Maukoro, and Awaite Canals, as well as round the Kerepeehi Block. The main drains for the removal of internal water have generally an easterly or westerly flow into rivers or canals, and each holding has an outlet drain on one or more of its boundaries. The bulk of these drains have practically an even grade, and if it were not for the range of the tides gravity drainage would be almost impossible. Wherever the drains cross the line of stop-banks automatic flood-gates have been constructed. The deep-peat areas have proved most difficult to reclaim, for loss of level through subsidence of the drained peat has caused large areas to be withheld from settlement.

Visited Mr. A. McClean's farm at Waitakaruru, and watched the dairy herd grazing off a break of pampas-grass. Mr. McClean has for a number of years been experimenting with pampas-grass as a supplementary stock-food, and recently the usefulness of this plant for general feeding has received wide attention. Some quite useful plantations have already been established on some of the poor peat areas of the Waikato, and there is no doubt that the plant has possibilities. No one could watch the cows on Mr. McClean's farm quietly grazing the pampas-plants without being impressed with its potentialities—an actual living fodder for winter feeding(18).

#### PIAKO COUNTY.

*September 6th, 1934: Morrinsville.*—A fine day after rain, and the rapid spring growth of grass just starting. The land conditions are generally similar to other parts of the Middle Waikato Basin—low, undulating hills of loams and clay loams, flat areas of silts and loams, and large peat swamps. Feed conditions vary greatly from farm to farm, even on the same class of land. Here a farm with excellent pastures of rye-grass and white clover showing a strong spring growth and having a production in the vicinity of 200 lb. of butterfat per acre, there a farm with bare close-grazed weedy pastures with a butterfat-production of about 100 lb. per acre. The essentials for high production per acre are good and highly productive pastures with good utilization brought about by heavy stocking and careful management. It is interesting to consider just how the increased production per acre from 100 lb. to 200 lb. is obtained. Really it is the application of the old principles of more stock, more manure, and better crops, exemplified in the sayings: "A full bullock-yard and a full fold make a full granary," and "Muck is the mother of money." It is again the application of the principles that brought about the great improvement in British farming in the eighteenth century, when the introduction of the field cultivation of roots, clover, and artificial grasses proved the pivot of agricultural progress. It enabled farmers to carry more and heavier stock; more stock gave more manure; more manure raised larger crops; larger crops supported still larger flocks and herds. These principles apply to grass-farming, and the start of the

upward climb in production is heavy top-dressing to give an increased grass-growth accompanied by increased stocking to utilize the grass and return manure to the soil. The composition of the pasture must be taken into account: for high production, highly producing strains of rye-grass and white clover are required; given these, fertilizers, stock, and management will do the rest. There is no reason why any Waikato dairying land of reasonable fertility should not be producing 175 lb. of butterfat per acre.

Saw a very poor and weedy crop of lucerne sown last spring, which the farmer was intending to try to improve by surface cultivation and by sowing more lucerne-seed. Thin stands cannot be thickened up satisfactorily in this way, and the only feasible method of improvement is to plough up the stand and resow it. Lucerne is established fairly easily on this undulating Waikato land if due attention is paid to essential points in cultivation—manuring, liming, and inoculation. This crop had been sown without inoculation, and the plants, being weak, had been smothered by the luxuriant growth of annual weeds.

*August 14th, 1935: Morrinsville to Manawaru.*—Grass-growth is excellent in all parts. The winter has been very wet, frosts absent, and grass-growth has continued all through the winter. Visited a 50 acre all-grass dairy-farm at Manawaru on which intensive grassland farming has been practised for a number of years, and the farmer was busy putting on the spring top-dressing of superphosphate. The farm is divided into sixteen fields of 3 acres each, all of which are supplied with water and open on to a central race. Butterfat-production has been as follows:—

| Season.    | Number of Fields. | Butterfat. | Butterfat per Acre. | Cows. | Super-phosphate. |
|------------|-------------------|------------|---------------------|-------|------------------|
|            |                   | lb.        | lb.                 |       | Tons.            |
| 1926-27 .. | 8                 | 8,043      | 161                 | 27    | 7½               |
| 1927-28 .. | 10                | 10,173     | 203½                | 32    | 14               |
| 1928-29 .. | 13                | 10,624     | 212½                | 37    | 22½              |
| 1929-30 .. | 16                | 11,027     | 220½                | 36    | 14½              |
| 1930-31 .. | 16                | 9,605      | 192                 | 33    | 15               |
| 1931-32 .. | 16                | 8,915      | 178                 | 35    | 12½              |
| 1932-33 .. | 16                | 10,456     | 209                 | 35    | 14               |
| 1933-34 .. | 16                | 9,772      | 195½                | 33    | 12               |
| 1934-35 .. | 16                | 11,132     | 222½                | 40    | 15               |

Although there are farms with a higher per-acre production, this farm shows fairly well what can be done with intensive management on a small all-grass dairy-farm. The period covers good seasons and poor seasons, seasons with herd trouble and grass-grub attack, and, finally, the highest production (222½ lb.) per acre occurred in the driest season of all. Briefly, the 50 acre farm has a production of 200 lb. of butterfat per acre from thirty-five cows, each field receives annually from 5 cwt. to 6 cwt. of super, and the whole of the supplementary feed is supplied by harvesting annually 20 acres for hay and silage. Annual crops are often advocated for supplementary feeding, but they are far more costly than the hay and ensilage method of feeding. If the land is ploughed up for cropping it has eventually to be laid down to grass again, and this costs £4 or £5 per acre.

## MATAMATA COUNTY.

*November 11th, 1934: Waharoa-Matamata-Tirau.*—A fine day and farmers everywhere busy with ensilage—there are fields that have been completely ensiled, fields and stacks partly finished, and closed-up fields which are not yet ready to cut. It is remarkable how quickly ensilage has spread throughout the Waikato: prior to 1928 practically no grass silage was made, now it is made on almost all dairy-farms. The importance of ensilage in the Waikato is shown in the following table:—

| County.           | 1933-34.             |                           |
|-------------------|----------------------|---------------------------|
|                   | Pasture cut for Hay. | Pasture cut for Ensilage. |
|                   | Acres.               | Acres.                    |
| Waikato .. ..     | 18,565               | 4,151                     |
| Waipa .. ..       | 17,604               | 7,481                     |
| Otorohanga ..     | 8,934                | 2,811                     |
| Hauraki Plains .. | 6,710                | 1,105                     |
| Piako .. ..       | 20,528               | 8,565                     |
| Matamata .. ..    | 17,471               | 6,269                     |

The great advantages of ensilage are that ensiling can be started in November, is independent of the weather, and fields cut early throw a good aftermath; when pits and trenches are used the ordinary farm labour can get through ensilage without extra assistance.

There are numerous patches of ploughed land being got ready for annual crops, chiefly swedes for winter feeding. The seed-beds are not likely to be particularly good—on some fields there is quite a lot of grass springing up between the furrow slices. In ploughing this light land for roots, a skim-coulter should be used on the plough and the furrow slices rolled before the land is disked: grass competition greatly reduces the yield of swedes.

The northern portion of Matamata County is a dairying district of great importance, and on passing the modern butter-factory at Waharoa one is reminded of the tremendous strides that have been made in the dairy industry in the past thirty years. This factory, to which there are 629 suppliers, for the 1934-35 season produced 4,740 tons of butter and 999 tons of cheese. In 1900 the Waharoa Cheese-factory, owned by the Assets Realization Board, was described as follows:—

“It is a wooden building with an iron roof, is divided into five departments, and the machinery is driven by a three-and-a-half horse-power stationary engine. In the cheesemaking department there are two vats and two presses. There are two storerooms and a large cheese-room for curing. The company has 120 milking cows, and there are in addition ten suppliers who milk in the aggregate about double that number.”

Matamata is a large county, and stretches from Waharoa in the north to the Waikato River, near Atiamuri, in the south: on the west it reaches to Mount Maungatautari (2,639 ft.), and on the east to Mount Puwhenua (2,047 ft.). The northern end consists of a plain of pumice

silt which rises gradually in the south to the Tokoroa Plain and thence to the Central Plateau. Northern Matamata County is a very intensive dairy-farming and fat-lamb-raising district, but in the south and east where the land rises to the Central Plateau considerable areas have been planted in *Pinus radiata* forests, which in 1933-34 covered 130,368 acres.

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## PULPY KIDNEY OF LAMBS (INFECTIOUS ENTEROTOXAEMIA) AND ALLIED DISEASES.\*

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### THE NATURE OF ENTEROTOXAEMIC DISEASES.

PULPY-KIDNEY disease of lambs and certain other similar conditions affecting older sheep are due to infectious enterotoxaemia—that is to say, there is a multiplication of certain micro-organisms (hence the term "infectious") in the intestine. As a consequence, there is produced a very powerful bacterial poison, or toxin, in the lumen of the intestine, which is absorbed into the blood-stream (hence the term "enterotoxaemia") by means of which it reaches all parts of the body and causes either sudden death or death after a few hours of acute illness.

When a post-mortem examination is made there is found an accumulation of fluid in the heart-sack (pericardium), the organs appear congested with blood, and the kidney substance may or may not be "pulpy." Pulpiness of the kidney is not present at the time of death, but may be found very shortly afterwards. Otherwise there is little to be seen at a post-mortem examination save slight changes which suggest toxæmia. An affected lamb, seen before death, shows symptoms pointing to acute abdominal pain, and is frequently convulsed. It strains painfully and passes soft, gassy fæces that are obviously abnormal.

### CAUSE OF PULPY KIDNEY.

It was first suggested in 1928 that pulpy kidney was due to absorption of a bacterial toxin from the gut. In 1930 the first definite proof of this was obtained, and the following year the organism responsible for it was isolated from affected lambs' intestinal contents. Further study of the characters of this microbe, both by the writer in New Zealand and by Oxer in Tasmania, showed that it was identical with one

\* Summary of a paper entitled "Infectious Enterotoxaemia and the Clostridium Welchii Group, with special reference to so-called Pulpy Kidney in Lambs," which was read at the 1935 conference of the Royal Society of New Zealand. The full text will be published shortly in the *New Zealand Journal of Science and Technology*.

described by Bennetts in Western Australia in 1932 as the cause of a disease of older sheep, which bore a striking resemblance to pulpy kidney in lambs. Bennetts named his organism *Bacillus ovitoxicus*. This name has now been changed to *Clostridium welchii*, type D, for the reason that it is, actually, a particular type of an already well-known organism called *Clostridium welchii*, of which three other types, known as A, B, and C, were already known.

#### CAUSAL ORGANISM AND ALLIED TYPES.

This group of organisms—the welchii group comprising types A, B, C, and D—is a complicated one, and there is probably much still to be learnt about it, but it is most interesting and of great importance to human and animal health. The following serves to emphasize its importance. *Bacillus welchii* is a constant inhabitant of the intestinal tract of man and animals, and through the fact that its spores are very resistant to destructive agencies, such as dessication, it may be found almost everywhere (in fæces, soil, dust, surface water, and so on). It first came into prominence during the late war, when it was found to be the common cause of gas gangrene supervening on shrapnel and other wounds. In 1926 a disease of newly born lambs, known as “lamb dysentery,” which occurs mainly in the North of England and caused very serious losses, was shown to be due to a germ having all the main characters of *B. welchii* but forming a different and much more powerful toxin. It is now known as *Clostridium welchii*, type B. In 1930 a third type (C) was found to be the cause of a disease of ewes in the Romney Marsh district in Kent. The disease is known to the local shepherds as “struck,” and is in the nature of an enterotoxæmia. In 1932, as already stated, Bennetts’s work in Western Australia on infectious enterotoxæmia revealed the fourth type (D), and the organisms found to be the cause of pulpy kidney in lambs were subsequently found to belong to that group also. As outlined here, the matter seems quite simple and straightforward, but in reality the inter-relationships of the four types are by no means clear as yet, and it is possible that still other types may be found as research continues.

#### ECONOMIC BENEFITS FROM THESE RESEARCHES.

The knowledge already obtained has proved of enormous economic value, especially in the control of certain diseases of sheep. Lamb dysentery caused heavy losses in the affected districts, in some flocks as many as 90 per cent. of the lambs dying within a day or two of birth. This loss can be almost completely eliminated by the inoculation of lambs at birth with type B antitoxin, or by vaccinating the pregnant ewes so that the lambs acquire supplies of antitoxin from the ewes’ colostrum. “Struck” of ewes in the Romney Marsh may cause the death of from 3 per cent. or 4 per cent. up to 20 per cent. of the ewe flock. From figures lately published it appears that vaccination will eliminate about 75 per cent. of these losses. Infectious enterotoxæmia of sheep and older lambs in Australia due to type D has caused huge losses in flush seasons, not only in Western Australia, but in the other States as well. Vaccination in Western Australia has reduced the losses there by 85 per cent. or better, and sheepowners in affected areas are adopting it as a preventive measure in ever increasing numbers. Recently very suggestive evidence has been obtained that “grass

disease" of horses in Scotland, a highly fatal disease that has taken an appalling toll of equine life in certain parts of Scotland for the past twenty or thirty years, and has lately shown a tendency to crop up in horses farther and farther south into England, is also a form of enterotoxæmia due to *C. welchii*, type D. If these findings are substantiated, there is no apparent reason why this, too, may not be completely controlled in a very short time.

#### VACCINES AND ANTITOXIN IN PREVENTION OF PULPY KIDNEY IN LAMBS.

Immediately the nature of the disease and the identity of the microbe causing it were discovered, vaccine and antitoxin supplies were prepared and trials made.

The vaccination of lambs was not a success. The majority of losses occur in lambs about three weeks old, and as for good results with vaccines of this sort, two doses are required with an interval of at least several days between them, the practical difficulties would be almost insuperable even supposing the method proved a success.

Antitoxin, on the other hand, is admirably suited to the prevention of this disease in New Zealand, as it occurs mainly over a period of a few weeks, in any given district, and an injection of antitoxin will confer immediate and strong immunity for a short time such as that. Experiments with antitoxin which have been made in Central Otago may be summarized as follows:—

Among 2,078 inoculated lambs only eight (0.38 per cent.) died of pulpy kidney, whereas among 2,123 control lambs in the same mobs forty-nine (2.3 per cent.) died. These results were obtained in 1932 and 1933 with single doses of antitoxin, the quantity injected varying from 2 c.c. to 5 c.c. Unfortunately antitoxin is costly to prepare, and except in special circumstances its use is not warranted on economic grounds, since the cost of the antitoxin per 100 lambs would exceed the value of the percentage of lambs likely to die of pulpy kidney if untreated.

#### VACCINATION OF EWES SUGGESTED AS A MEANS OF PREVENTING PULPY KIDNEY IN LAMBS.

Vaccination of young lambs is impracticable and the use of antitoxin is effective but unsound economically. There is, however, another line of attack which may yet prove both practicable and economical. That is the vaccination of the ewes during pregnancy so that the lambs will obtain antitoxin, in the first days of life, from their dam's colostrum (first milk). The grounds for thinking this might be effective were carefully outlined in the paper of which the present article is a brief summary, and a plea was made for the suggestion to be given a trial.\* If this method proved effective it should also be economical, as the cost of vaccinating each ewe with the necessary two doses of vaccine should not exceed about 1½d. per head. Moreover, the vaccine used is of a type that could be safely injected by the farmer with very little tuition. Similar vaccine is already bought and used by the farmers themselves in Australia and South Africa.

\* Trials were made in Central Otago this past season, and the results, which were highly encouraging, will be published in this *Journal* shortly.

## PREVENTIVE MEASURES BASED ON PREDISPOSING FACTORS.

Considerable space is given to evidence regarding the type of lamb and the feed conditions associated with losses from the disease, and the conclusion is arrived at that while, *in the majority of cases*, it is the fast-growing lamb on abundant milk-supply from its dam which succumbs to the disease, cases undoubtedly occur—and from Leslie's observations at Lincoln College they seem to be particularly prevalent in Canterbury—where the reverse is the case, the lambs being of sub-normal birth-weight and growth-rate. The evidence is that sudden changes on to milk-stimulating feed are dangerous. It is not yet clear why these factors should predispose to the disease, but it seems most probable that they cause digestive disturbances in the lamb, which alter the conditions existing inside its intestine and thus provide the causal organism, if present, with a favourable environment in which to grow and produce its toxin.

Preventive measures depending on flock-management must therefore be devised according to the circumstances in which the losses occur. This is obvious, since, if the predisposing factors vary, preventive measures that are effective in one case will be useless in another. For example, where the disease is associated with rapid growth and abundant milk, or a sudden flush of milk-stimulating feed, efforts to reduce the milk-intake by changing to less stimulating feed, yarding, exercise, &c., are indicated, whereas, to take such steps in cases where losses are related to impoverishment of the ewes, low birth-weight and growth-rate will serve only to make matters worse rather than better.

Because the feed factor is so commonly beyond adequate control, in view of the diversity of circumstances under which this disease of lambs may occur, it is considered the more essential that the possibilities as a preventive measure of vaccination of the ewes be thoroughly investigated.

In conclusion, it is pointed out that pulpy kidney disease of lambs is not the only form of enterotoxæmia causing losses in New Zealand. Some evidence was obtained by the writer in 1931 that sudden deaths among hoggets on turnip crops is of a similar nature, and it is highly probable that here, as in Britain and Australia, the same organism is responsible for some of the mortality which occurs in older sheep. If such cases are encountered, as seems inevitable, it is a comfortable reflection that failing other means of prevention there is every reason to be hopeful that vaccination will prove effective.

The paper concludes with a list of thirty-three references quoted in the text.

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The losses occasioned to sheep-farmers through parasitism of their flocks is probably greater than from any other cause. Much information regarding the control of parasites in sheep has been disseminated by the Division during recent years, but too much reliance is placed by sheep-farmers on drenching alone, whilst neglecting the adoption of methods of sheep management and feeding, without which lasting results cannot be obtained. The influence of the nutritional aspect of the sheep in combating the effect of parasites is a very vital one, hence the necessity of maintaining lambs on short pasture providing the maximum of nutrition.—*Report, Director, Live-stock Division.*

## APPLICATION OF ORCHARD-SPRAYS.

### II. THE PORTABLE SPRAYING-SYSTEM.

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IN the earliest methods of portable spraying the spray mixture, together with a hand-operated pump, were carried or wheeled to the orchard trees by man-power. Such methods proved too wasteful of time for large-scale commercial spraying, so that horses were used for pulling a wheeled chassis on which the mixing-tank and pump were mounted. Steam-power for driving the pump was tried in 1894 (Lodeman, 1896), but gave place to petrol-engines in 1900, and these have been used almost exclusively ever since. More recently, increased mobility of the outfit has been obtained by the use of mechanical traction. The same power unit has been used, in some instances, for the dual purpose of hauling the outfit and driving the pump.

#### PORTABLE SPRAYING-EQUIPMENT.

*Pump.*—Under New Zealand conditions, it is not practicable for more than two men to spray from one outfit. With a volume delivery of 3 gallons per minute at each nozzle (or combination of nozzles) the pump-capacity required for a one-man outfit is approximately 5 gallons per minute, and for a two-man outfit 8 gallons per minute. A working pressure at the pump of approximately 350 lb. per square inch is required for efficient mist production.\*

*Power Unit.*—For driving the pump petrol-engines are invariably employed, 2 brake horse-power being required for the smaller and 3 brake horse-power for the larger outfit.

*Mixing-tank.*—Wooden tanks, being both light and resistant to corrosion, are usually employed for holding the spray mixture. In recent years, however, the production of corrosion-resistant steel has made possible the use of metal tanks. These have greater durability than wooden tanks and are less subject to leakage.

The maximum capacity of the mixing-tank for a horse-drawn outfit is limited to approximately 150 gallons owing to the difficulty of hauling larger volumes of spray mixture. Where mechanical traction is used larger volumes of spray mixture can be hauled. The maximum efficient size, however, is approximately 250 gallons since the excessive time taken to empty larger tanks may result in deterioration of certain spray combinations—e.g., lead-arsenate and lime-sulphur—with consequent tree injury.

*Haulage Power.*—Horses are usually employed for pulling the spray outfit, one or two being used according to the contour of the orchard, condition of the soil, size of the mixing-tank, &c. Spraying efficiency is increased where tractors are used for haulage, since the greater mobility of the outfit reduces the time taken to spray the orchard. However, capital cost and high rate of depreciation limit the use of tractors to large orchards where there is sufficient supplementary work in cultivation, &c., or where contract spraying is undertaken.

\* The relationship between pump-capacity, volume delivery at the nozzles, pump speed, &c., has been discussed previously under stationary systems. See this *Journal*, Vol. 52, p. 1.

*Water-supply.*—The location of the water-supply is important, for if it is not central a large amount of time is spent in travelling to replenish the mixing-tank. Where the supply is not adjacent to the orchard, it is advisable to install an auxiliary pump and pipe-line for driving water to a conveniently situated holding-tank. In large orchards increased efficiency may be obtained by locating such tanks at various points. Holding-tanks should be raised to permit of rapid filling of the mixing-tank by gravitation and should hold sufficient water to provide, with the aid of the auxiliary pump, an uninterrupted supply. Where an ample supply of stream or well water is available holding-tanks are unnecessary, but some method of rapidly filling the mixing-tank is required. For the purpose an attachment known as a self-filler may be used. These fillers are operated by the pump, and will deliver up to 35 gallons per minute, depending on pump capacity and pressure, but will not work efficiently if the water-supply is more than 16 ft. below ground-level.

#### MANAGEMENT.

The usual method adopted with horse-drawn outfits is to spray two rows of trees on either side of the avenue through which the outfit is driven. Hose-lengths of approximately 60 ft. are used, the outfit being moved each time eight trees have been sprayed. With properly trained horses driving can be directed by word of command from one of the nozzlemen without interrupting spraying.

Where the outfit is tractor-drawn a different method is adopted, since frequently moving the outfit results in wastage of time in driving and in increased petrol-consumption by the tractor. Hose-lengths of up to 120 ft. are used and large blocks of trees sprayed, so that the outfit requires to be moved only once before the mixing-tank is emptied. The size and shape of the blocks of trees and the sequence in which the trees are sprayed are similar to those previously described for stationary systems.

A method which is extensively used in America and which has recently been adopted in a few orchards in New Zealand is to spray from platforms on the outfit whilst driving between the rows of trees. By this means the work of spraying is considerably lightened, and it is claimed that time is saved. The principal objection to this method is that where trees are dense or overhanging efficient coverage is difficult to obtain owing to the limited angle from which spray can be applied. Further, in order to save time the volume delivery at the nozzles has to be considerably increased, resulting in a wastage of spray. As it is necessary in this method to drive between each row of trees, consolidation of the orchard soil and damage to trees, cover crops, &c., is more extensive.

Owing to the relatively severe conditions under which portable pumps work, constant attention to release-valves or pressure-regulators, pressure-gauges, &c., is necessary for efficient working. It is advisable to cover the pump and engine with some form of light screen to protect the metal parts from spray-drift. In many cases the horses are also covered during spraying operations. At the completion of each day's spraying the pump should be washed out with water, and the outfit housed in a shed or covered with a waterproof sheet.

#### COMPARATIVE EFFICIENCY OF PORTABLE AND STATIONARY SYSTEMS.

In recent years there has been a gradual replacement of the portable by the stationary system. The advantages possessed by the latter

are—(1) Spraying is not hindered by adverse soil conditions, and can be completed with a saving in time of 30 per cent. to 40 per cent., thus resulting in greater efficiency in disease-control; (2) damage to cover crops, trees and fruit, and consolidation of the orchard soil is negligible; (3) hill-side orchards can be sprayed more easily; (4) where electric power is available electric motors can be used. These are easier to operate and less subject to mechanical trouble than petrol-engines; (5) running-costs are lower, since haulage power is not required; (6) depreciation of the spray pump and engine, &c., and the cost of repairs and replacement of parts are less; (7) labour-costs are reduced.

The following are the main disadvantages of the stationary as compared with the portable system: (1) Time is wasted where a few varieties requiring particular spray treatment are scattered through the orchard; (2) higher pump-pressure is necessary owing to loss of pressure in the pipes; (3) the capital cost of installation is higher, due mainly to the cost of piping. Depreciation of the piping-system, however, is so low that it may be regarded as a permanent improvement to the orchard; (4) a certain amount of spray is wasted and time spent in washing out the piping-system.

For the majority of orchards greater efficiency can be obtained by the stationary system, the use of the portable system being limited to small areas—up to 5 acres—or to orchards where various spray treatments are required for a number of different varieties.

#### LITERATURE CITED.

LODEMAN, E. G. (1896): *The Spraying of Plants.* 399 pp.

### VARIETIES OF BARLEY, SEASON 1935-36.

HITHERTO there has been no official information available respecting the extent to which the different varieties of barley have been cultivated in the Dominion. With a view to obtaining some data on the subject, farmers were asked to indicate varieties of barley when furnishing (in September, 1935) their annual returns of wheat, oats, barley, and potatoes sown or intended to be sown for the 1935-36 season.

The first column of figures in the following table shows the areas of the different varieties actually specified in the replies received from growers. The second column of figures shows for each variety of barley the total estimated area for the season 1935-36.

| Variety of Barley. |    |    |    | Actual Area<br>specified. | Total<br>Estimated Area,<br>1935-36. |
|--------------------|----|----|----|---------------------------|--------------------------------------|
|                    |    |    |    | Acres.                    | Acres.                               |
| Chevalier          | .. | .. | .. | 4,989                     | 7,840                                |
| Spratt Archer      | .. | .. | .. | 3,670                     | 5,760                                |
| Plumage Archer     | .. | .. | .. | 1,720                     | 2,700                                |
| Goldthorpe Spratt  | .. | .. | .. | 2,121                     | 3,330                                |
| Cape               | .. | .. | .. | 2,002                     | 3,150                                |
| Skinless           | .. | .. | .. | 1,693                     | 2,660                                |
| Other varieties    | .. | .. | .. | 677                       | 1,060                                |
| Totals             |    |    |    | 16,872                    | 26,500                               |

The first four varieties shown above are malting barleys, the aggregate area being estimated at 19,630 acres. Some of the "other varieties" may come within the malting category, in which case the area quoted would be correspondingly increased.

—*Monthly Abstract of Statistics.*

## HOW TO FORWARD PATHOLOGICAL SPECIMENS TO THE VETERINARY LABORATORY, WALLACEVILLE.

A CONSIDERABLE amount of trouble arises through packets of specimens or samples posted to the Veterinary Laboratory, Wallaceville, not being securely or sufficiently packed by the senders. These packets are sometimes the cause of other mail matter becoming damaged through leakage from badly packed specimens, and complaints have been received from the Post Office in regard to the objectionable and possibly dangerous nature of the contents of some packets causing such contamination. At times loss of the material submitted for examination results and consequently a report cannot be given on the case.

Therefore, farmers and others utilizing the services of the Veterinary Laboratory in the diagnosis of troubles affecting live-stock particularly are requested to observe the following rules when submitting specimens for examination :—

(1) All specimens or samples, other than milk-samples, when forwarded by post must be sent by either packet-post or by letter-post. *The postal regulations prohibit the use of parcel-post except in the case of milk-samples.*

(2) The rail service may be used if considered more suitable by the sender. Railage must be paid by the consignor.

(3) Every packet posted must be conspicuously marked with the words "*Specimen for examination.*"

(4) The postal regulations require that any such liquid or substance must be enclosed in a receptacle hermetically sealed, or otherwise securely closed, and the receptacle itself must be placed in a strong wooden, leather, or metal case in such a way that it cannot shift about, and with a sufficient quantity of some absorbent material (such as sawdust or cotton-wool) so packed about the receptacle as absolutely to prevent any possible leakage from the package in the event of damage to the receptacle. (Newspaper makes a fairly good absorbent; if at all possible avoid the use of dusty material in packing.) The Post Office may destroy any package not properly packed.

(5) When packing any specimen of a solid nature, such as a dead bird or a piece cut from an organ of any animal, it is advisable to take a piece of clean cloth and place it (the cloth) in a solution of formalin or methylated spirits, then wring it out and wrap round the specimen. This acts as a preservative and prevents the specimen becoming too putrid during transit. The wrapped specimen should then be placed in a strong container, as mentioned in paragraph No. 4 (strong cardboard can be made to serve) with sufficient packing to hold it firmly in place.

(6) A note should be enclosed in the package giving the following information: (i) Date of despatch; (ii) nature of specimen and particulars of origin; (iii) purpose for which examination required; (iv) name and address of sender.

(7) In addition, a letter should be despatched in the first mail giving full details with as complete a history of the case as possible. This enables a proper look-out to be kept for the package in case it is delayed in transit, and at the same time facilitates laboratory examination and report to the sender.

(8) Address postal communications to "Officer in Charge, Veterinary Laboratory, Private Bag to Wallaceville, Wellington."

Parcels consigned by rail should be addressed "Veterinary Laboratory, Wallaceville."

The address for telegrams is "Vetlab, Upper Hutt."

—Live-stock Division.

## OVERSEAS TRADE.

EXPORTS of merchandise during the calendar year 1935 amounted to £46,538,678, and commodity imports to £36,287,544, so that external trading in commodities during the year resulted in an export surplus of £10,251,134, as compared with £16,003,295 in 1934 and £15,424,553 in 1933. The quantities and declared values of the principal export commodities of farm origin in the calendar years 1934 and 1935 are shown in the following table:—

| Item.                           | Unit of Quantity. | Quantity.  |            |                                                | Value.     |            |                                                |
|---------------------------------|-------------------|------------|------------|------------------------------------------------|------------|------------|------------------------------------------------|
|                                 |                   | 1934.      | 1935.      | Comparison 1935-34 (Increase + or Decrease -). | 1934.      | 1935.      | Comparison 1935-34 (Increase + or Decrease -). |
|                                 |                   |            |            | Per Cent.                                      | £ (N.Z.)   | £ (N.Z.)   | Per Cent.                                      |
| Butter .....                    | Cwt.              | 2,614,519  | 2,789,298  | + 6.7                                          | 10,042,776 | 13,616,740 | +33.6                                          |
| Casein .....                    | Cwt.              | 57,744     | 65,167     | +12.9                                          | 149,666    | 161,700    | + 8.0                                          |
| Cheese .....                    | Cwt.              | 1,984,496  | 1,727,552  | -12.9                                          | 4,694,459  | 4,376,512  | - 6.8                                          |
| Frozen beef (including chilled) | Cwt.              | 827,310    | 817,586    | - 1.2                                          | 871,359    | 979,711    | +12.4                                          |
| Frozen lamb (whole carcasses)   | Cwt.              | 2,584,405  | 2,605,526  | + 0.8                                          | 7,903,337  | 8,184,521  | + 3.6                                          |
| Frozen mutton (whole carcasses) | Cwt.              | 901,938    | 1,025,305  | +13.7                                          | 1,595,564  | 1,837,600  | +15.2                                          |
| Frozen pork ..                  | Cwt.              | 426,426    | 491,640    | +15.3                                          | 1,138,488  | 1,308,222  | +14.9                                          |
| Frozen meats, other ..          | Cwt.              | 229,368    | 266,457    | +16.2                                          | 378,207    | 458,914    | +21.3                                          |
| Meats, potted and tinned        | Cwt.              | 44,348     | 74,205     | +67.3                                          | 127,090    | 216,217    | +70.1                                          |
| Sausage-skins ..                | Lb.               | 4,524,412  | 4,192,001  | - 7.3                                          | 625,394    | 787,261    | +25.9                                          |
| Milk, dried ..                  | Lb.               | 17,493,122 | 14,578,002 | -16.7                                          | 338,539    | 272,382    | -19.5                                          |
| Milk and cream, preserved, &c.  | Lb.               | 4,069,328  | 6,205,078  | +52.5                                          | 69,169     | 98,508     | +42.4                                          |
| Apples, fresh ..                | Lb.               | 57,763,643 | 37,790,819 | -34.6                                          | 716,780    | 467,422    | -34.9                                          |
| Pears, fresh ..                 | Lb.               | 4,915,070  | 3,786,790  | -23.0                                          | 62,060     | 57,071     | - 8.0                                          |
| Cattle-hides ..                 | Number            | 476,235    | 521,745    | + 9.6                                          | 439,013    | 441,325    | + 0.5                                          |
| Sheep-skins with wool ..        | Number            | 2,949,971  | 2,405,251  | -18.5                                          | 524,309    | 381,283    | -27.3                                          |
| Sheep-skins without wool        | Number            | 9,243,726  | 11,765,293 | +27.3                                          | 725,782    | 894,181    | +23.2                                          |
| Wool ..                         | Bale              | 741,916    | 647,801    | -12.7                                          | 12,516,425 | 7,096,873  | -43.3                                          |
| Seeds, grass and clover         | Cwt.              | 48,751     | 71,649     | +47.0                                          | 166,511    | 215,738    | +29.6                                          |
| Tallow ..                       | Ton               | 27,662     | 25,277     | - 8.6                                          | 480,354    | 630,638    | +31.3                                          |

—Monthly Abstract of Statistics.

## INVENTIONS OF AGRICULTURAL INTEREST.

APPLICATIONS for patents, published with abridged specifications in the *New Zealand Patent Office Journal* from 30th January, 1936, to 13th February, 1936, include the following of agricultural interest:—

No. 72599: Milk claw; G. E. Harrison. No. 73820: Seed-stripping apparatus; A. A. Russell, jun. No. 74041: Manure-mixing device; A. C. Anderson. No. 75131: Plant-raising; Sprout Ltd. No. 75234: Sheep-shears; G. J. Burge. No. 73291: Milking-machine; J. Underwood. No. 73356: Tilling-implement; F. and H. Petty. No. 73368: Harrow; W. B. Anderson and H. C. Russell. No. 73428: Control of bees in hives; C. A. Sharp. No. 74129: Insecticidal composition; E. I. Du Pont De Nemours and Co.

Copies of full specifications and drawings in respect of any of the above may be obtained from the Commissioner of Patents, Wellington, price 1s. prepaid.

## SEASONAL NOTES.

### THE FARM.

#### The Cereal Crops.

In the main grain-growing districts work in connection with the cereal crops is an important if not the main task of this season of the year. Though during recent years cereal-growing has benefited considerably from research, the work in essential features has not changed in that the basic factors in obtaining success continue to be the provision of suitable soil conditions, the carrying-out of appropriate cultivation, the use of varieties adapted to the purpose and circumstances of the case, and the adoption of appropriate means of controlling diseases and pests. In short, advances in cereal-cropping have not given us a short or easy road to success—indeed, it would be unwise to expect such a road.

In wheat-growing a well-drained soil which favours the natural deep-rooting habit of the crop is essential to success. Hence, if portions of paddocks which are to be sown in wheat, and especially in winter wheat, are inclined to be badly drained during the wet season, then practical means of draining such portions should be employed, otherwise wheat on such undrained land is very likely to perish if any considerable wet period occurs. In the cropping-system one of the best places for wheat is after red clover, peas, or tares. Usually these crops leave the ground in a fertile friable condition, so that a good crop may be obtained with a minimum of cultivation and fertilizer. Another favourable cropping order is wheat after rape. After rape, the land is worked easily, is available at the right season, and any manure applied with the rape is likely to be of appreciable benefit to the wheat. Growing wheat on land just ploughed out of pasture frequently is carried out with good results provided the preparatory cultivation is commenced in good time and is thorough. Wheat after potatoes is also usually successful.

Wheat fares best in a fine firm seed-bed. The advisability of firmness sometimes makes it possible to dispense with ploughing after peas or potatoes, it being necessary to precede the wheat merely by two or three diskings. When wheat is to follow pasture, skim-ploughing should be done early in the autumn, and if it has not been done at the time of publication of these notes it should be carried out as soon as possible. After the skimmed furrows have been exposed to weathering for some six or eight weeks, they should be disked and the land then ploughed to the full depth. By this procedure finely pulverized material is placed at the bottom of the full furrow and lumps are brought near the surface, where they may be pulverized by further cultivation. Early cultivation of grassland gives time for the buried sward to decay properly and to enrich the remainder of the soil; on the other hand a buried sward which has not been broken down by decay may prove very detrimental later, especially under dry conditions, by interfering with the rise of moisture from the lower layers of the soil. When wheat follows another cereal the stubble should be disked or grubbed and the land ploughed later to full depth. When wheat follows grass or another cereal there is always danger of grass-grub infestation. For autumn sowing of cereals small clods are an advantage, provided they are on the surface. They give the seedlings shelter during the winter and gradually crumble into a desirable fine loose surface, which is preferable to the setting of a hard surface layer which may readily occur when the surface soil is fine from the outset.

In the main wheat-growing areas of the South Island spring-sowing of wheat should be practised only when circumstances necessitate it. The

ideal sowing-season is autumn and early winter. In the most southerly wheat areas and in the North Island spring sowing is usually most suitable. The standard varieties—Hunter's, Pearl, and Velvet—require autumn or early-winter sowing; Solid Straw Tuscan may be sown in the spring as well as in the autumn and early winter. In the North Island Jumbuck, which dominates, is sown in the spring.

Extensive field experience over a period of years has confirmed thorough investigations in showing that over a wide range of country it proves distinctly profitable to use with wheat 1 cwt. of superphosphate an acre. While the majority of farmers regularly apply this knowledge, it is somewhat surprising that a minority, but nevertheless in the aggregate, a considerable number, of farmers ignore it, and this for no satisfactory reason.

Wheat is subject to certain serious diseases, outstanding features of which are (1) they readily cause heavy loss in the returns from the crops if proper control measures are not employed, and (2) the proper control measures are simple and relatively inexpensive. Further reference to them follows.

Oats to be used for the production of winter and early-spring feed and subsequently to be allowed to develop for grain-production should be sown in April or in early May. The proved kinds of Gartons are the best all-round oat for the South Island. Algerians rightly are popular for the production of green-feed in autumn or spring and for the provision of good chaff. Gartons, which do not stand grazing to the same extent as Algerians, should be fed off once only and that quickly. When barley and Algerian oats are grown primarily for green feed, a series of grazings when the growth is relatively low is preferable to a single feeding-off of tall growth; the series of grazings of short growth avoids undue waste by trampling and provides better balanced and more attractive feed. As a rule autumn-sown oats and barley respond profitably to an application of 1 cwt. to 3 cwt. an acre of fertilizer of which superphosphate is the main constituent.

#### Control of Cereal Diseases by Simple Seed Treatment.

The modern methods of controlling certain grave diseases of cereals are dealt with in some detail in this *Journal* by J. C. Neill in July, 1934, and by T. A. Sellwood in December, 1935. The treatments being considered control smut of all cereals excepting the loose smuts of wheat and barley, which can be controlled only by the hot-water treatment. The value of the hot-water treatment in this connection has been demonstrated well in Canterbury. Unfortunately it calls for a degree of control of temperatures which is impracticable in ordinary farms. Despite this, a good deal has been accomplished in Canterbury, particularly in barley-growing, as a result of work carried out by the Canterbury Seed Co., Ltd., in co-operation with the Department of Agriculture.

The modern trend in the treatment of seeds of cereals is to replace wet pickles, usually solutions of bluestone or formalin, by various substances in dust form. The main advantages of the dusts are the elimination of the danger of injury to the seeds and the convenience arising from the fact that dusted seed keeps at least as well as untreated seed, so that the treatment may be carried out at any convenient time between harvest and sowing instead of just at the busy time of sowing. Further, dusting of seed obviates reinfestation from sacks, &c., between treatment and actual sowing. Against these substantial advantages is to be set a somewhat greater cost which, however, it is considered widely is more than offset by the advantages specified. Full information about the use of the substances and the equipment employed in dusting seed is obtainable from officers of the Fields Division. Prominent among the substances used are the organic-mercury dusts (Ceresan, Agrosan, &c.). These are effective in the control of the smuts of all cereals except the loose smuts of wheat and barley, which,

as already mentioned, may be controlled only by the hot-water treatment. Dusts of copper carbonate and copper oxychloride have proved effective in the treatment of wheat, but not in that of oats and barley.

Treatment of seed with formalin carried out in the approved manner controls smut, but the seed may be damaged seriously if sowing is delayed or if the soil is dry and remains so for a few days after sowing. Further, if the formalin is not used in the approved manner, the treatment may be ineffective or injurious.

Treatment with bluestone (copper sulphate) may be made effective against smut, but commonly it results in injury to germination and a slowing of early growth.

For treating wheat with formalin, 1 pint of commercial formalin should be added to 60 gallons of water, and for treating barley and oats, 1 pint to 40 gallons of water. A popular and convenient method of treatment is to wet the seed thoroughly by sprinkling through a fine nozzle of a watering-can while turning the grain with a shovel on a floor, 1 gallon of the above solution being required for 4 bushels. After thorough mixing the seed should be made into a heap and left over-night covered with sacks soaked in the formalin solution. The sprinkle method may also be adopted in using bluestone, 1 lb. of bluestone being used with 10 gallons of water. Treatment may also be by means of the steeping method.

#### General Forage Crop Work.

The extensive and considerable rains since Christmas have given an exceptional colour and growth for this time of the year to pastures over wide areas. A point of practical importance is that the unusual appearance of the pastures is likely to prove deceptive as to its bearing on winter and spring feed. Because of the possibility of early cold conditions the growth of grass before winter may not be so great as current appearances seem to promise, and, further, in any case much of the autumn growth may be of a lush immature character lacking the value for winter feeding that attaches to the more mature growth frequently available for winter.

Another point of practical importance is that dairy cows, because of the present conditions, are yielding exceptionally well, and may do so right into early winter. If they do this, they will not build up the bodily reserves which are so often created in the autumn and without which the feeding in winter and early spring will need to be appreciably better than suffices when body reserves are built up in the autumn. Last year parts of Southland illustrated this position in a striking and unfortunate manner. Exceptionally heavy mortality of dairy cows that occurred in certain districts in the spring was correlated with an autumn which was abnormally favourable for butter-fat production. As a result of this the dairy cows entered the winter in lower condition than usual, and so felt later adverse conditions more gravely than would have been the case had they been able to draw on greater bodily reserves. It was significant that in the same districts sheep, which, of course, had not been subjected to the strain of exceptional autumn production, came satisfactorily through the same seasonal conditions that caused such heavy mortality in dairy cows.

Because of the foregoing conditions it is clear that whenever the feed position is at all weak reliance should not be placed upon recent rains, and cropping designed to strengthen the position generally should be pushed on as much as possible along the lines outlined in these notes last month.

For the purpose of building up the maximum supplies of feed for winter and early spring, care should be taken to turn into silage or hay, before frost injury has occurred, any available green maize or millet. Silage should be made in preference to hay if the amount of green material available is not so small as to lead to undue wastage in ensilage.

Autumn work with lucerne at times is of importance. Occasionally the growth made during the later part of the season is grazed. The trampling necessarily associated with such grazing definitely favours the

entrance of grass; hence in the interests of the lucerne such grazing is usually inadvisable. While circumstances can be imagined in which the interests of the lucerne should be sacrificed, these circumstances are not so common as are the cases in which the interests of the lucerne are endangered. This is especially true of districts of good rainfall, in which grass may become such a strong competitor of lucerne as to prove one of the worst weeds affecting it and in which, because of "flush" of autumn feed on the pastures, the feed obtained by grazing the lucerne in the autumn is seldom acutely needed. In many instances it has been found advantageous to allow several inches of growth on lucerne as it enters the winter. This obviates the drain of the plants which takes place when fresh shoots are produced towards the end of the growing-season, and hence the plants are stronger and so better able to face competition in the spring from winter invaders. Further, the early development of such invaders is also checked by the shading effect of the growth on the lucerne.

Especially in parts of Taranaki lucerne that has become invaded by weeds is at times cultivated in April. The implement used for this practice should be fitted with narrow tines to avoid as much as possible mutilation of the lucerne plants. Cultivation carried out so late as to exclude the possibility of any further considerable growth of the lucerne is frequently followed by an immediate sowing of 1 bushel to the acre of Algerian oats. This practice gives in the spring a heavy growth of well-balanced feed, and in the meantime the development of more permanent plants which would prove serious weeds of lucerne is checked. It is highly desirable to arrange to utilize the spring growth of oats and lucerne for ensilage early in the season: if it is left standing past the stage when early ensilage is possible, it readily may do considerable damage to the lucerne stand as a result of the shading caused by the oats. The autumn sowing of oats with established lucerne has been confined mainly to districts of free soils in which sufficient loose surface material for the satisfactory covering of surface-sown oats is obtainable with the minimum of cultivation. It may be surmised that if much cultivation is necessary for this purpose the lucerne stand is likely to become unduly damaged.

#### Pasture-management.

Pasture-management, along the lines discussed recently in these notes, is of seasonal importance. It usually is advisable to apply fertilizer early to newly established pastures. The purpose is to avoid any possible deterioration that would arise from low initial fertility: it is usually more profitable by top-dressing to prevent early deterioration than later on to renovate the swards.

—R. P. Connell, *Fields Division, Palmerston North*

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## THE ORCHARD.

### Export of Fruit.

THERE is little doubt that the russetting of fruit has been the major problem of many exporters this season. The difficulties of grading on this account have been intensified. With the large proportion of the crop affected by russetting a great amount of otherwise "Extra Fancy" and "Fancy" grade fruit has gone into the "Good" grade, and quite a considerable proportion in some instances has had to be rejected altogether. A feature of the position has been the extent of rough russet experienced.

The harvesting of the mid-season varieties is almost at a close, and the picking of the later varieties will shortly be commenced. It may be reiterated here that first pickings should be select, that only the larger sizes should be removed, and that the portion of the crop intended for export should be picked at the optimum state of maturity suitable for carriage

to the distant markets. It should also be borne in mind that, with coloured varieties, colour is not necessarily the only guide by which to pick, that a highly coloured crop does not necessarily indicate that picking should be commenced early; and the converse, because the crop is low in colour, that picking should be unduly delayed.

Because of the quantity of fruit that has now passed over the sizing-machines, care should be taken to see that those parts with which the fruit comes into contact are kept clean and free from grease and grit. Following the packing of the more conical varieties, such as Jonathan and Delicious, it frequently happens that the packing of the flatter Sturmer Pippin is done too tightly and too high, and this has been observed to cause fairly extensive bruising. This is a common fault occurring year after year.

Generally, those responsible for the grading of the fruit will have become well grounded in the work, and the maintenance of the required grading standards should not be difficult. Growers should remember their fruit has to be transported to a distant market and sold in competition with fruit of other countries, and an indifferent grade standard is but adversely affecting themselves. It is not just a matter of squeezing it past the Inspector; and yet, unfortunately, there are some not above boasting that they have managed to get this or that low-grade line away. Such a practice does incalculable harm to the good standard and name of New Zealand fruit generally.

#### Local Markets.

Fruit intended for local cool storage should receive a careful grading, and all fruit showing disease and skin punctures should be culled. Only the higher-grade fruit should be stored, as frequently the realizations for low-grade fruit ex cool store do not exceed the total marketing-costs.

The fruit intended for local marketing should be tree-ripened as far as possible. When it is intended to hold fruit in ordinary shed-storage prior to marketing it should be graded carefully to cull all fruits with skin punctures, as these are liable to decay. The cases of fruit should be stacked on cleats in the coolest possible position, and excessive draught through the shed eliminated to avoid undue wilting. Although somewhat conducive to rots if broken surfaces are to be found, an occasional wetting of the fruit by pouring water over the top of the fruit stack will to a great extent eliminate shrivel, and, if such wetting is carried out judiciously the fruit keeps considerably longer in a fresh condition.

In the harvesting of pears for cool-storage purposes no delay should occur in getting the fruit into store as soon as possible following picking.

#### General.

A check should now be made of the case material and packing supplies to see that sufficient is on hand to carry through to the finish of the season.

In the packing-sheds all waste fruit should be gathered up and destroyed and not left about in cases to rot.

The removal of points of congestion and other improvements which could be effected to working-conditions in the packing-shed should be attended to now or be noted for attention prior to the commencement of next season.

—R. G. Hamilton, Orchard Instructor, Hamilton.

#### Citrus Culture.

THE moist weather experienced this summer will have left the ground in good condition for the sowing of cover crops, which should be done in the early autumn, so that the crops will be ready to plough in at a suitable date later on. The autumn application of fertilizer, superphosphate and carbonate of lime each 3 cwt. per acre, should coincide with the sowing of the lupin or other seed, and thereby stimulate growth of the resultant cover crop. Nitrogen in the form of sulphate of ammonia and nitrate of soda,

at the rate of 2 lb. to 5 lb. each for bearing-trees may be applied at this period, or organic manures such as blood and bone may be applied. Contrary to opinions which have been held, the results of official experiments have shown that the growth produced from applications of nitrogen is not likely to suffer injury by other than severe frosts during the winter and spring. The working of the soil prior to the sowing of the cover crop should always be done so as to make a slight slope away from the base of the tree, as good drainage is essential to the health of the root-systems of all trees. After the very wet season experienced, the ground will greatly benefit by an additional application of lime, which should be sown on the surface of the soil when the ploughing has been completed for the winter.

*Brown-rot.*—The loss every year from brown-rot is a serious matter, and varies somewhat in severity according to the rainfall. The cutting-away of trailing branches should be undertaken, as the spores developing on the surface of the soil rapidly spread to both the fruit and foliage near the ground. The Bordeaux (3-4-50) spray recommended in the February notes for verrucosis assists in controlling this disease also.

—L. Paynter, Orchard Instructor, Auckland.

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## POULTRY-KEEPING.

### Management of Breeding-stock.

By this time all hens which are intended for use for breeding purposes during the coming season should have been selected, separated from the rest of the flock, and placed on a ration that is not likely to encourage egg-production.

It is a mistake to try to obtain the last few eggs from such birds and expect them to be in the best condition early in the spring to produce eggs containing the maximum amount of fertility and vitality. If hens are forced by heavy, high feeding to lay too late into the autumn it is likely to weaken them, and, as anything that weakens parents has a tendency to affect their offspring, it is a much wiser policy to see that the prospective breeders are given plenty of time to recuperate.

At times some of the best layers continue laying even in spite of the fact that they are being fed on a lighter ration, and such hens should be separated from the rest and fed on a light grain ration for two or three weeks.

### Treatment for Parasitic Insects.

All birds should be examined carefully for parasitic insects, and, if necessary, treated. If only a few require to be treated, the dusting of fine powder into the feathers will rid them of body lice. A good dusting mixture can be made up of equal parts of lime, fine dry earth, and sulphur. Where a large number have to be treated, the best method is the application of a small quantity of nicotine sulphate along the perches just before the birds go to roost. It is also desirable to treat hens for internal parasites, which may be done by first starving the birds for about twenty-four hours, then feeding a mash made up of equal parts of pollard and bran, in which has been mixed a teaspoonful of Epsom salts to each three birds, and one teaspoonful of spirits of turpentine to every five birds. The spirits of turpentine should first be mixed with the bran; the amount of Epsom salts required should be dissolved in hot water, and when it is dissolved thoroughly and the water has become cold, the solution may be used to moisten the bran and pollard. The best results are obtained when the mixture is given cold.

### Feeding the Breeders.

The art of feeding breeding-birds is to so feed them that they will be able to recuperate after the heavy laying-season, come quickly through the moult, and be in the best condition to give good fertile hatchable eggs early

in the spring. The more natural the conditions under which the breeding-stock can be kept the better it is, and if a good clean free range can be provided the best results should be secured. Birds for breeding must, however, be fed well yet carefully during the moulting period, for if neglected during that time, trouble, and perhaps losses, may be experienced during the hatching and rearing season.

There is a tendency for hens to put on too much condition when they are not producing, and this must be guarded against, especially in the case of prospective breeders. It is advisable to handle some of the birds from time to time, and if they show signs of getting over-fat, the amount of grain being fed should be slightly reduced, and the litter increased in order to encourage the taking of more exercise.

Most utility poultry-keepers have their own particular system of treating their breeding-birds. The following is a popular and successful system, and is adopted where only limited room is available : As soon as the breeding-hens have been selected, they are separated from the rest of the flock and placed in a house where plenty of litter is provided, and at least 4 square feet of floor-space is allowed per bird. They are kept in the house, and fed on a grain ration which is made up of wheat, maize, and barley (or oats). When the moult is just about over, the birds are then let out into fresh pens, and a mash is fed each day, as well as the grain mixture, this mash being made up of two parts, by measure, of pollard to one of bran, and about 5 per cent. of meat-meal is added. A regular supply of succulent green feed should be given each day.

#### **The Breeding-cockerels.**

Where cockerels are being reared for breeding purposes, it is well to keep a close watch on them, and to market any that are not showing sufficient promise before they get too staggy. Nothing equals free range for the growing cockerels, but unfortunately free range is not possible on many plants. However, some poultry-keepers are inclined to overcrowd the cockerels, a practice which does not give them a fair chance, and which also seems to overlook the fact that the male bird is more than half the breeding-pen. Cockerels should not be overcrowded nor fed too much mash or rich food. Everything should be done to build up their vigour and constitution.

The chief characteristics to look for in a good breeding-cockerel are—A good, strong, type, showing plenty of width between the legs, which should be straight, with feet well set ; back of good length and breadth, giving room for the internal organs ; head strong and masculine (a most important point), showing character not too coarse but not too fine ; a good breeding-hen should be fine in head, but it is usually better to see the male a little coarser and with a real masculine look ; comb well set on the head, and following the line of the neck, and of medium size ; eyes keen, bright, and straight. Most of these points apply to all utility breeds, but, of course, due allowance should be made for breed characters.

#### **New Blood.**

The poultry-keeper should ever be on the watch for signs which indicate that his flock, or strain, has reached the highest limit in its capacity.

Some poultry-farmers realize that the average size of their birds is becoming too small, that a larger number of the pullets are maturing a little too early, that smaller eggs are being produced, and that perhaps more of the young stock have crooked breasts. Nevertheless, because the average egg-yield from the flock has been better than usual, they are afraid to introduce any new blood.

No doubt there is always a certain amount of risk in introducing new blood, but it is well to remember that, generally speaking, the higher the average egg-production the greater the danger of deterioration, and the

first signs of weakness should be taken as a warning that extra care, or perhaps a slight change in one's breeding methods, is necessary. If the introduction of fresh blood is left too long it may take years to build up the stamina and quality of the flock, and correct any weakness which has been allowed to creep in.

Just how often new blood is required, it is impossible to say, as much depends on individual conditions. Plants have been visited where no fresh blood has been introduced for ten and twelve years, and still the quality, constitution, and productiveness of the flock has been quite satisfactory. These, of course, were exceptional cases, and the owners of such plants were keen, enthusiastic breeders who never sacrificed quality for quantity: only hens above a certain weight were placed in the breeding-pens and the breeding-cockerels were always bred from a few of the best hens of the flock. However, years of visiting many poultry plants and assisting in the selection and mating of breeding-birds, has shown that if the average White Leghorn utility poultry-farmer made it a rule to introduce some fresh blood about every three years it would be to his advantage. As previously mentioned, there is always a certain amount of risk in bringing in new blood, especially with some of the heavy breeds, but it is wiser to risk the temporary loss of some breed characters or maybe a slight reduction in the egg-yield for a season than the more serious loss of stamina. \*

If proper care is taken to test out the new blood before introducing it through the whole of the home flock, there should not be a great danger in its introduction. Fresh blood may be secured by the purchase or exchange of eggs early in the season. A number of young cockerels may also be secured in the same way, and later on the best kept for testing with some of the best of one's own birds.

A popular way is to purchase a good cockerel about this time of the year, and mate him early in the spring to a few selected hens of the home strain, the best of the progeny from such mating to be then mated through the flock. On the other hand, if the poultry-keeper has a good cock bird that has left good stock, the best way to introduce new blood is to purchase a few good breeding-hens before they moult, and later on mate them with the proved cock bird. If the progeny turn out satisfactory, it usually is quite safe to mate the best of the cockerels with the home flock.

Where it is intended to test out some new blood during the coming season, no time should be lost in placing your order if a good selection is to be had. It is a good idea to look around breeders' plants, in your own district, where a personal selection can be secured, as this may prove more satisfactory than sending a long distance.

—C. J. C. Cussen, Chief Poultry Instructor, Wellington.

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## THE APIARY.

### Preparations for Winter.

As the honey-flow is now definitely over for the season and extracting finished, the next work will be the preparation of the bees for winter. It is assumed that in most cases sufficient stores have been left in the hives. From 30 lb. to 40 lb. will be required to tide a colony over the winter and early spring.

If sealed combs of honey from clean colonies are not available, colonies that are short of stores should be fed as soon as possible with syrup composed of equal parts of sugar and water. It is better to feed heavily now where necessary, than to wait until the bees have used up their meagre stores. The bees cannot leave their cluster during the cold months of

winter and early spring to take down any syrup that may be offered them, or generate sufficient heat to evaporate any surplus moisture it may contain. It is not commended to feed sugar syrup, but feeding of sugar syrup is advisable in the absence of sealed honey stores, as there is a risk of introducing disease by the feeding of honey unless it is definitely known that the apiary from which it is obtained is quite free from foul-brood and has been so for some years.

It is generally admitted that honey-fed bees have a better constitution than those fed with sugar, and build up better in the spring. There is also reason to believe that some sorts of honey are better than others, but of this we have no definite proof. There is a marked difference in the specific gravity of our honeys.

The entrance of all colonies should now be reduced. The average colony will require an entrance 3 in. to 4 in. wide. If the height is more than  $\frac{1}{16}$  in., this should also be reduced in order to prevent mice getting into the hive.

When stacking away the supers of combs for the winter, a sheet of newspaper should be placed between each super and a roof or its equivalent on top, to keep out mice and wax-moths. Any foundation that may be left over should be packed away in a light and air-proof box. It becomes very brittle if left exposed to the atmosphere.

It is advisable to keep a sharp look-out for foul-brood, and, if it is discovered, either to deal with it at once by one of the methods recommended or to destroy the colony. It does not pay to risk the spreading of foul-brood by robbing during the winter.

If robbing sets in, a strip of wood in which an escape has been fitted should be placed across the entrance of the colony that is being robbed, and left there until after sunset. Then the entrance should be reduced to not more than 1 in. in width.

#### Weak and Queenless Colonies.

As advised last month, queenless colonies should be disposed of by uniting them with strong queen-right colonies. This is most readily accomplished in the evening when all field bees have returned. After taking the roof and mat from the queen-right colony, place a sheet of newspaper immediately over the top of the frames and carefully place the queenless colony on top. No smoke will be required if the hive is handled gently. Weak colonies should be similarly united if the queen is of little value. If the queen is young, brood-rearing will probably be kept up for some time, and such colonies, though weak, will probably be worth saving. This is best accomplished by shifting them into a small hive, called a nucleus box, large enough to take only four frames.

—E. A. Earp, *Senior Apiary Instructor, Wellington.*

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## HORTICULTURE.

### Vegetable Crops.

WITH the commencement of occasional winter frosts towards the end of the month, April is outstanding as the harvest period for many of the main crops, which are used to best advantage when harvested in fine weather and given the necessary storage conditions previously described in these notes. In the absence of ample supplies of well-prepared farm manure, the land which is not required for immediate planting in small fruits or vegetable crops, such as asparagus, rhubarb, and spring cabbage, should be sown down at once in cover crops which make good growth during winter for turning under before replanting in the spring. Land required for planting early crops in the months of July and August should be dressed with such manure

as is available or sown in a quick-growing cover crop such as white mustard, 1 oz. or 2 oz. of seed to the square rod. The remainder of the land may be sown with a legume such as vetches, or dun or partridge field peas, or horse beans, together with oats, or Cape or black barley, 1 lb. of seed of each to the square rod. Such crops should produce good growth for turning under in early spring.

Cabbage-plants, raised from seed sown during the month of February, should now be planted out in dull weather, taking every care to avoid injury and selecting only plants of good type and constitution; they should be set low and planted firmly. Asparagus and rhubarb may be planted out as soon as the plants die back, or it may be done during the month of August. Where the climate is sufficiently warm land may be prepared for sowing peas of a vigorous type, such as Stratagem, during the month of May, when also, in frost-free localities, early potatoes are planted.

The sad havoc among cabbage and cauliflower crops caused in the past by the caterpillar larvæ of the white butterfly has been greatly reduced by the introduction, breeding, and liberation of natural parasites by the Plant Research Station at Palmerston North, but a certain amount of protection is still required by these crops which are now maturing. A dust composed of arsenate of lead powder and hydrated lime, or a spray of the lead powder, has been used with great success, and it is satisfactory during the period the young plants are becoming established. The rough leaves carry a considerable amount of this material after spraying. This not only makes the crop unsuitable for human consumption, but also leaves the supplier liable to prosecution if cabbages are placed on the market in this condition. The difficulty has been overcome to some extent by withholding the spray after the cabbages commenced to heart up and cauliflowers to form a head. A non-poisonous control for this pest has now been discovered in the form of derris dust and sprays. These have been carefully tested in competitive trials under local conditions by the Entomological Section of the Plant Research Station, and the report by W. Cottier published in the January number of this *Journal* shows them to be quite satisfactory, although a little more expensive than the arsenate remedies. They are therefore most suitable for application during the later stages of the growth of these crops at intervals of two or three weeks, as may be necessary. The powder is made from the roots of species of plants known as derris, which grow in the East Indies. Rotenone is one of the active principles of derris, and "the potency of the insecticide is commonly expressed on the basis of the proportion of rotenone it contains," and this to be effective should be 0.5 per cent. to 0.75 per cent. The dust should be applied at the rate of 20 lb. to 25 lb. per acre according to the manufacturers' instructions.

Where grassland is to be broken up for vegetables it should be skim-ploughed now, and some weeks later, when the turf is killed, cross-ploughed deeply, and subsoiled to break up the subsoil without bringing it up to the top. Headlands and corners may have the preparation completed by spade-digging so that all will be ready for planting the hedges and shelter-trees which will be required.

Seeds of cabbage, cauliflower, and lettuce may be sown for planting out in the spring. In cold districts they will later require the protection of a cold frame.

#### Small and Sundry Fruits.

The planting-season for the hard-wooded crops of small and sundry fruits commences towards the end of May. The preparation of the land should now be completed and plants ordered for delivery as soon as they are ready for lifting. In the home garden the results obtained are often unsatisfactory owing to insufficient consideration being given to the arrangement and situations chosen for the plants. In a situation about the verge of vegetable plots or among other herbaceous plants, the deep digging which

is necessary under the circumstances causes such crops as gooseberries and currants to produce more wood than fruit. Such crops as these are more satisfactory if given an area to themselves so that their requirements may be fully supplied. Deep cultivation, turning under a heavy dressing of manure, and thoroughly cleaning the land of all bad weeds, while growing a vegetable crop, is often the most suitable preparation. If the plants are set about 3 ft. to 4 ft. apart, and 6 ft. between the rows to facilitate access, they will give a good account of themselves if annual pruning and shallow cultivation are given in season. Raspberry-canes may be planted singly 1 ft. apart in the row.

In warmer districts crops of this class are generally best represented by passion-fruit, loganberries, and grape vines on trellises about 9 ft. apart and the plots divided from the rest of the garden by evergreen hedges of guavas or Feijoa, planted at intervals of 2 ft. to 3 ft.

The Chinese gooseberry, *Actinidia chinensis*, is steadily growing in public esteem; its generous crop of egg-shape and size fruit at mid-winter helps to supply variety at that rather lean season. It is a vigorous plant that demands good soil and a large trellis or pergola on which to climb. While it is doing this it should be watched carefully, and all vigorous growth that is badly placed or tends to crowd should be pinched back after a few leaves have formed. If this is done regularly during the growing-period appearance will be enhanced and cropping hastened. In addition to its fruit crop, it is a handsome shade plant which drops its leaves in winter.

In the small home-garden such fruiting-trees as the fig, mulberry, walnut, and persimmon, which are deciduous, and the evergreen avocado, loquat, and citrus plants are often best planted as specimen trees or groups on a lawn, or in its vicinity, where they may well serve an ornamental as well as a useful purpose. The kind of tree to be planted should be decided after careful consideration of local experience, and the position which it is to occupy should be given the same attention, as it probably will be a conspicuous feature that cannot well be removed without detriment.

While most small fruiting-plants have a life of eight to ten years, the strawberry, like most herbaceous plants, requires to be replanted every three or four years to obtain the best results; indeed, in the warmer districts, where it matures rapidly, replanting is done annually when the crop is grown for the market. The same generous preparation as that previously described is quite suitable; indeed, it is usually best to plant strawberries in the same enclosure as the hard-wooded small fruits, so long as the disturbance of replanting does not interfere with the other crops. It is advisable to work in a liberal dressing of blood and bone manure, and then, when the surface has been smoothed out and the land become firm, to set the plants firmly 9 in. to 12 in. apart and 24 in. to 27 in. between the rows. The plants should be chosen with great care, as they should be not only of a good fruiting strain, but of a variety suited to the district, as they are unaccountably fastidious in that respect. In other respects almost any climate or soil here is suitable, after good preparation, so long as it does not dry out in summer. Planting should be done now without further delay, especially in the cooler localities.

The planting of loganberries, tree tomatoes, passion-fruit, and Cape gooseberries is best deferred until the spring.

#### The Homestead Garden.

New lawns should be cut when the grass is 2 in. or 3 in. high and in dry condition. Cut it as high as the adjustment of the mower permits, as close cutting is detrimental until a good sole of grass has been established. For this work the mower should be well oiled and set carefully: with most kinds of machines this is done by an arrangement which permits the cutting-edge of the bottom blade being raised or depressed. The right

position is that where the revolving cutting cylinder makes an even and firm contact with the bottom blade along its whole length, without jamming. After rain, when the surface is dry, the lawn should be rolled carefully with a light roller weighing about 2 cwt. ; on light soils a heavier implement may be used when the grasses are well established.

In most districts the April frosts terminate the display in herbaceous borders. Those borders devoted to annuals should be cleared, and, after a dressing of bonedust has been worked in, planted with spring-flowering bulbs and other herbaceous plants, such as anemones, ranunculus, tulips, hyacinths, wall flowers, primroses, violas, &c., which can be cleared in November for the summer planting. Every third year at this season such a border or bed should be trenched and a good dressing of decayed farm manure worked into the bottom of the trench before replanting. The perennial herbaceous border should be tidied up and given any manurial dressing required. Every third or fourth year at this time of the year it should be cleared completely and reconditioned before replanting. It is advisable to lift one kind and variety of plant at a time and plant out sufficient selected pieces in well-marked nursery rows in the kitchen garden ; and when all is clear to trench and manure the border thoroughly, grading the surface carefully. Shallow cultivation should be given afterwards at intervals to destroy seedling weeds, and it is well to take the opportunity to eradicate all bad weeds such as couch-grass, &c. When the ground is settled and clean, replanting may be done when the ground is sufficiently dry. This will be most effective if it is well planned, making the groups of each colour rather large in proportion to the size of the border.

Herbaceous perennials which dislike disturbance may be planted in the shrubbery border where, if the soil and situation are to their liking, they will give a good display in season with very little attention ; in fact they thrive best when undisturbed for long periods. They include *Agapanthus umbellatus*, *Amaryllis belladonna*, *A. purpurea* (*Vallota purpurea*), pæonies, bluebells (*Scillas*), and many varieties of lilies and narcissus.

—W. C. Hyde, *Horticulturist, Wellington.*

## SEED-WHEAT CERTIFICATION.

### CERTIFIED CROPS.

UNDER the Government scheme for the certification of seed wheat the following growers have seed for sale from crops which have passed both field and grain inspections :—

| Variety.           | Grower.                                     | Acreage. |
|--------------------|---------------------------------------------|----------|
| Cross 7 .. ..      | F. W. Gartery, Springbank, Rangiora ..      | 20       |
|                    | Hollis Bros., Mount Hutt, R.M.D., Rakaia .. | 8        |
|                    | R. B. Paton, Pukeuri, North Otago ..        | 25       |
| Dreadnought ..     | J. Sanson, Kia Ora R.D., Oamaru ..          | 12       |
| Hunter's II ..     | *H. P. Dulieu, R.M.D., Springton ..         | 9        |
|                    | *P. J. Dulieu, R.M.D., Springton ..         | 8        |
| Solid Straw Tuscan | C. Early, R.M.D., Springton ..              | 12       |
|                    | *J. D. Henderson, Halkett, Canterbury ..    | 10       |
|                    | Est. C. Smith, Springbank, Rangiora ..      | 30       |
|                    | *S. Smith, Box 27, Lincoln ..               | 17       |
|                    | J. S. Thomson, Kirwee, Canterbury ..        | 37       |

\* Passed subject to machine-dressing of seed.

—Fields Division.

## ANSWERS TO INQUIRIES.

IN order to ensure reply to questions, correspondents must give their name and address, not necessarily for publication, but as a guarantee of good faith. Letters should be addressed to the Editor.

### LICE ON HORSES.

G. M., Taihape :—

Two horses are badly affected by lice. One has been out with a cover on for a while, and the other is a young one which has not worn a cover. Please advise how to clean these horses thoroughly.

#### The Live-stock Division :—

Lice are especially troublesome in animals that are turned out with a cover on them, as lice breed readily in the warm moist coat under the cover. Moreover, when covered continually the skin and hair cannot rid themselves of natural secretions, shed hairs, flakes from the skin-surface, &c., and these provide further encouragement to the lice. Animals that are not thriving owing to poor feeding or worm-infestation are also very liable to infestation with lice. Grooming and attention to the feed are part of the treatment. Washing the skin with a 2-per-cent. solution of carbolic sheep-dip, Jeyes' fluid, or any similar coal-tar disinfectant destroys the lice, but the eggs are unaffected and hatch out later. The treatment to be fully effective must therefore be repeated in from eight to ten days' time.

Before applying the treatment for the first time the animal should be clipped, and the clippings carefully collected and burnt, as they contain many lice and large numbers of nits (eggs). There will also be numerous lice and nits on the underside of the cover that has been on the animal, and this must therefore be well soaked in the above solution, then washed out and dried.

### EFFECT OF COLD ON BLUE LUPINS.

F. W. G. R., Springfield :—

Is this district, 1,600 ft. above sea-level, suitable for growing blue lupins ?

#### The Fields Division :—

It is doubtful if lupins would survive an average winter at an altitude of 1,600 ft. above sea-level. The blue lupin is generally considered to be a winter hardy plant, but experiences in Canterbury at comparatively low levels indicate that fully grown crops of lupins may be destroyed completely by frost following rain or snow.

Several cases of winter killing were experienced by farmers on the plains this season, following the snow which fell in June, and a number of crops died during the previous winter when frost followed rain. Most of the crops affected were fully grown, and apart from late-sown autumn crops, which may not be sufficiently far advanced to withstand early frosts, this stage of growth appears to be the one at which lupins are most susceptible to frost injury.

### HERNIA OF HORSE.

R. H. T. C., Kurow :—

A thoroughbred horse, four years old, has a bulge on its navel about 1 in. thick and 1½ in. long. Can it be removed, and, if so, how ?

#### The Live-stock Division :—

From the description, the horse probably has a small umbilical hernia, which has most likely been there since birth. It is a small sac composed of skin, fibrous tissue, and peritoneum ; in this there may be a small portion of bowel.

In foals such a small hernia frequently disappears spontaneously, but this does not occur readily in older animals. However, in a hernia of this kind it may not be necessary to do anything at all unless there was a tendency for it to enlarge, or if the animal suffered any inconvenience such as colicky pains.

The swelling can be obliterated by a comparatively simple operation, for which the services of a veterinary practitioner are required.

## TREATMENT FOR TUTU-POISONING.

M. C. H., Otaki Railway :—

Could you advise me what to do to animals caught in the early stages of tutu-poisoning?

The Live-stock Division :—

It is often very difficult to apply medicinal treatment to animals suffering from tutu-poisoning, seeing that the trouble causes more or less severe brain symptoms, which renders the animal difficult to handle. Very useful treatment for this trouble, when it can be applied, is the internal administration of ordinary liquid ammonia, or carbonate of ammonia, mixed with milk or thin gruel; in addition, a large dose of linseed oil, not less than 1 quart, should be given. The dose of ordinary liquid ammonia should be 1 oz. in a quart of milk or gruel, or it may be mixed with the quart of linseed oil. If carbonate of ammonia be used the dose is  $1\frac{1}{2}$  oz. mixed as above.

## DRENCHING SHEEP.

M. A. N., Hangaroa :—

What are the quantities of Black Leaf 40 and bluestone used as a dose for sheep, lambs, hoggets, &c.?

The Live-stock Division :—

The quantities of bluestone and Black Leaf 40 for use in drenching sheep for stomach worms are as follows: Dissolve 1 lb. of bluestone in 5 gallons of soft water, then stir in 16 oz. of Black Leaf 40. The bluestone solution must not be prepared in a metal vessel; it is necessary to use either wood, earthenware, or enamel-ware. In the latter case the enamel must be intact, as even a small flaw which exposes the metal underneath will destroy the value of the bluestone-solution. The doses of the above mixture for sheep are as follows: Small and weakly lambs,  $\frac{1}{4}$  oz. with  $\frac{1}{4}$  oz. water added to it; strong lambs,  $\frac{1}{2}$  oz.; hoggets and older sheep, 1 oz. to  $1\frac{1}{2}$  oz.

## BLOW-FLIES ATTACKING SHEEP.

V. L. J., Ngaruawahia :—

What are the best measures to minimize the trouble and loss caused by blow-flies attacking lambs?

The Live-stock Division :—

The blow-fly chiefly concerned is the golden haired blow-fly and the small green bottle-fly. The maggots of the latter soon penetrate the skin of the sheep and burrow deeply into the muscles if not discovered and dealt with in time. As an important preventive measure the flocks in which the trouble has appeared or is likely to appear should be properly dipped in a powder arsenical dip, and if there is a fair growth of wool on the sheep the protection afforded by dipping should continue for a considerable time. Before dipping, the sheep should be daggled and thereafter kept clean. Another preventive measure is to see that all dead sheep are buried or burned. When a sheep is observed to be blown, all dirty or matted wool should be removed by the shears and a solution of non-poisonous fluid dip applied to the part; or a very good dressing is one part oil of turpentine to three parts of olive oil. The greatest care should be taken to see that all the maggots are destroyed, as when the wool is being removed they immediately try to bury themselves amongst the surrounding wool. It is advisable therefore to examine dressed animals on subsequent days. Sheep in exposed areas are not so liable to attack as those in sheltered valleys or in the vicinity of bush or plantations. A fly-trap may be made out of a kerosene or petrol tin. Cut the top out of the tin, put a skinned rabbit in it, with two quarts of water, cover tightly with wire gauze and thrust the narrow end of a good-sized funnel through the centre of the gauze, and place in a sheltered position.

## WEATHER RECORDS: FEBRUARY, 1936.

Dominion Meteorological Office.

### NOTES FOR FEBRUARY.

FEBRUARY is usually a dry month, but this year not only did we have by far the wettest February hitherto recorded in New Zealand, but, except for the western and southern portions of the South Island, it is doubtful whether even in a winter month so much rain has fallen over the country as a whole. Flooding occurred at times over practically the whole of the North Island, and in parts of the Auckland Province the floods of the 1st to 2nd were of record proportions. In South Marlborough, Canterbury, and north-eastern Otago also there was heavy flooding. In Canterbury the floods of the 19th to 21st were the most severe since 1923, and the Ashley River rose to unprecedented heights. In consequence of the wet weather there has everywhere been a rank growth of pasture. Stock are in good condition generally, and the milk-yield has been well maintained. For sheep the grass is too rank and soft, and lambs are not fattening well. Severe damage has been done to the wheat crop, which otherwise would have been excellent. In many cases grain, both standing and in stooks, has sprouted. Conditions have been extremely unfavourable for haymaking. The apple crop, however, appears to be satisfactory.

*Rainfall.*—Over the whole of the North Island extremely wet weather prevailed, and the totals were generally about three to four times the average for February, though in places with a westerly aspect conditions were, relatively, not quite so bad as elsewhere. In Marlborough, most of Canterbury and eastern Otago, similar conditions prevailed. Most of Westland, the Mackenzie County, the interior of Otago, and Southland had less than the average rain. In south Westland there were some heavy falls.

*Temperatures.*—In most cases the mean temperatures were below normal, but there were frequent exceptions to this rule. On the West Coast means were generally above the average. Marlborough and most of Canterbury experienced a cold month, the departures from normal being approximately 2° F. Few frosts were reported.

*Sunshine.*—Generally the amount of sunshine was well below the average, deficiencies of 40 to 50 hours being common. It was the absence of sunshine and consequent low maximum temperatures which was principally responsible for the low mean temperatures for the month.

*Storm Systems.*—During the night of the 1st and the morning of the 2nd a deep cyclone which had originated some days before as a tropical cyclone to the north-west of the New Hebrides, rapidly increasing its speed of movement, travelled down the western side of the Auckland Peninsula, and thence across the centre of the North Island and away in a south-easterly direction. In most of the Auckland Province north-easterly gales were followed, after the centre passed, by south-westerly. Elsewhere over the North Island southerly or south-easterly gales were experienced. Though short-lived, owing to the rapid movement of the storm, these winds rose to whole gale force in some exposed positions. It was probably the most violent storm ever experienced at most places in the North Island, and certainly caused more destruction than any previous one. Extremely heavy rains occurred, falls of 4 in. to 11 in. being the rule. Though there were some heavy rainfalls, principally in Marlborough, the South Island was little affected.

The remaining storms were rather complex in structure, and none was severe until the centre had passed New Zealand, although heavy rains were produced. On the 7th to 8th there were southerly gales; the temperature dropped sharply; snow fell on the ranges of the South Island; and there were many violent thunder and hail storms. Rain was practically general, and in many places heavy. Canterbury had heavy rains on this occasion.

Another very wet period was from the 17th to the 22nd, rainfall being very heavy, especially in Canterbury, where there was severe flooding and much damage done.

A depression which passed on the 25th deepened when to the eastward, and was followed by a severe southerly gale. Again there was heavy rain at many places.

## RAINFALL FOR FEBRUARY, 1936, AT REPRESENTATIVE STATIONS.

| Station.                         | Total Fall. | Number of Wet Days. | Maximum Fall. | Average February Rainfall. | Total Rainfall to Date. | Average Rainfall to Date. |
|----------------------------------|-------------|---------------------|---------------|----------------------------|-------------------------|---------------------------|
| <i>North Island.</i>             |             |                     |               |                            |                         |                           |
|                                  | Inches.     |                     | Inches.       | Inches.                    | Inches.                 | Inches.                   |
| Kaitaia .. ..                    | 6.11        | 11                  | 4.56          | 3.50                       | 18.19                   | 7.44                      |
| Russell .. ..                    | 13.58       | 7                   | 11.84         | 2.99                       | 37.59                   | 6.24                      |
| Whangarei .. ..                  | 13.74       | 15                  | 11.41         | 3.87                       | 23.19                   | 7.80                      |
| Auckland .. ..                   | 9.27        | 10                  | 6.38          | 3.57                       | 16.16                   | 6.54                      |
| Hamilton .. ..                   | 9.06        | 16                  | 3.48          | 2.91                       | 16.00                   | 6.48                      |
| Rotorua .. ..                    | 12.17       | 14                  | 5.27          | 3.84                       | 22.99                   | 7.95                      |
| Kawhia .. ..                     | 7.55        | 10                  | 2.69          | 2.86                       | 13.16                   | 6.41                      |
| New Plymouth .. ..               | 6.29        | 16                  | 2.83          | 3.94                       | 14.73                   | 8.12                      |
| Riversdale, Inglewood .. ..      | 11.77       | 17                  | 5.89          | 6.03                       | 24.13                   | 13.54                     |
| Whangamomona .. ..               | 7.46        | 13                  | 4.51          | 3.89                       | 15.41                   | 9.47                      |
| Hawera .. ..                     | 8.53        | 16                  | 2.50          | 2.40                       | 12.10                   | 5.91                      |
| Tairua .. ..                     | 11.94       | 12                  | 7.91          | 4.68                       | 18.72                   | 8.34                      |
| Tauranga .. ..                   | 13.52       | 15                  | 6.28          | 3.78                       | 17.90                   | 7.81                      |
| Maraehako Station, Opotiki .. .. | 8.57        | 10                  | 2.17          | 4.14                       | 19.07                   | 7.73                      |
| Gisborne .. ..                   | 10.86       | 10                  | 3.02          | 3.46                       | 15.22                   | 6.18                      |
| Taupo .. ..                      | 9.36        | 14                  | 3.50          | 2.74                       | 17.43                   | 6.11                      |
| Napier .. ..                     | 11.93       | 12                  | 4.43          | 2.46                       | 17.06                   | 4.96                      |
| Hastings .. ..                   | 11.32       | 10                  | 4.81          | 2.25                       | 16.02                   | 4.18                      |
| Whakarara Station .. ..          | 14.22       | 8                   | 5.45          | ..                         | 21.74                   | ..                        |
| Taihape .. ..                    | 10.85       | 15                  | 2.57          | 2.43                       | 15.50                   | 5.59                      |
| Masterton .. ..                  | 11.32       | 11                  | 2.52          | 2.78                       | 14.96                   | 5.34                      |
| Patea .. ..                      | 8.17        | 16                  | 3.92          | 2.40                       | 12.00                   | 5.99                      |
| Wanganui .. ..                   | 8.52        | 14                  | 4.44          | 2.42                       | 12.22                   | 5.25                      |
| Foxton .. ..                     | 8.06        | 13                  | 2.85          | 2.07                       | 11.78                   | 4.21                      |
| Wellington .. ..                 | 9.90        | 14                  | 2.67          | 2.75                       | 13.24                   | 5.64                      |
| <i>South Island.</i>             |             |                     |               |                            |                         |                           |
| Westport .. ..                   | 3.97        | 11                  | 1.04          | 5.35                       | 6.94                    | 13.55                     |
| Greymouth .. ..                  | 3.58        | 14                  | 0.83          | 6.21                       | 9.19                    | 15.38                     |
| Hokitika .. ..                   | 4.44        | 11                  | 1.72          | 7.22                       | 8.23                    | 17.32                     |
| Ross .. ..                       | 6.28        | 9                   | 2.33          | 8.90                       | 9.92                    | 21.30                     |
| Arthur's Pass .. ..              | ..          | ..                  | ..            | 9.90                       | ..                      | 24.02                     |
| Okuru, South Westland .. ..      | 17.05       | 7                   | 10.06         | 9.66                       | 24.57                   | 22.25                     |
| Collingwood .. ..                | 6.36        | 10                  | 1.65          | 5.13                       | 17.13                   | 11.71                     |
| Nelson .. ..                     | 3.68        | 10                  | 0.71          | 2.63                       | 6.72                    | 5.53                      |
| Spring Creek, Blenheim .. ..     | 6.00        | 12                  | 1.45          | 2.18                       | 7.92                    | 4.40                      |
| Seddon .. ..                     | 5.91        | 11                  | 1.92          | 1.85                       | 8.52                    | 3.69                      |
| Hanmer Springs .. ..             | 16.07       | 14                  | 5.01          | 3.26                       | 17.58                   | 7.21                      |
| Highfield, Waiau .. ..           | 14.74       | 11                  | 5.08          | 2.60                       | 15.58                   | 5.58                      |
| Gore Bay .. ..                   | 9.81        | 13                  | 3.36          | 2.80                       | 10.84                   | 5.26                      |
| Christchurch .. ..               | 6.93        | 11                  | 2.60          | 1.56                       | 8.18                    | 3.89                      |
| Timaru .. ..                     | 8.39        | 11                  | 5.79          | 1.79                       | 9.94                    | 4.18                      |
| Lambrook Station, Fairlie .. ..  | 5.13        | 10                  | 2.62          | 1.81                       | 6.30                    | 4.24                      |
| Benmore Station, Clearburn .. .. | 1.28        | 13                  | 0.38          | 1.62                       | 2.64                    | 4.39                      |
| Oamaru .. ..                     | 6.80        | 13                  | 3.15          | 1.79                       | 9.36                    | 3.83                      |
| Queenstown .. ..                 | 1.36        | 11                  | 0.94          | 1.97                       | 3.96                    | 4.84                      |
| Clyde .. ..                      | 0.73        | 8                   | 0.32          | 1.06                       | 1.61                    | 2.91                      |
| Dunedin .. ..                    | 8.53        | 17                  | 2.40          | 2.71                       | 10.09                   | 6.12                      |
| Wendon .. ..                     | 2.54        | 13                  | 1.03          | 2.26                       | 4.17                    | 5.46                      |
| Balclutha .. ..                  | 2.04        | 9                   | 0.82          | 1.99                       | 2.66                    | 4.30                      |
| Invercargill .. ..               | 2.33        | 15                  | 0.80          | 3.18                       | 6.44                    | 7.18                      |
| Puysegur Point .. ..             | 3.89        | 13                  | 0.97          | 5.74                       | 11.74                   | 13.36                     |
| Half-moon Bay .. ..              | 1.32        | 11                  | ..            | 4.08                       | 4.48                    | 8.90                      |